The Industry Profile on Visual Impairment

Authors: Wendy Strobel*, Jennifer Fossa, Carly Panchura, Katie Beaver, and Janelle Westbrook
Contributors: Stephen Bauer, Sajay Arthanat, Joe Lane, Deborah Gilden, & Bill Crandall

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University at Buffalo
Center for Assistive Technology
Rehabilitation Engineering Research Center on Technology Transfer
Kimball Tower, Room 322, 3435 Main Street
Buffalo, NY 14214-3079
Phone: 716.829.3141 Fax: 716.829.2420 Voice/TDD 800.628.2281
http://cosmos.ot.buffalo.edu/t2rerc/

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Editors: Wendy Strobel*, Jennifer Fossa, Carly Panchura, Katie Beaver, and Janelle Westbrook

Contributors: Stephen Bauer, Sajay Arthanat, Joe Lane, Deborah Gilden, & Bill Crandall

*Wendy Strobel, the communicating author can be reached by phone at 716.829.3141 x 140 or via e-mail at wstrobel@buffalo.edu

Rehabilitation Engineering Research Center on Technology Transfer
Center for Assistive Technology
State University of New York at Buffalo
Kimball Tower, Room 322, 3435 Main Street
Buffalo, NY 14214-3079
Phone: 716-829-3141
Fax: 716-829-2420
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Introduction

The *Industry Profile on Technology for Visual Impairment* is a reference document for technical and clinical research, product development, market analysis and segmentation, and general education. The *Industry Profile* includes market segments size and descriptions, clinical issues, technology overview, products, reimbursement sources, manufacturers, trade associations, and related publications. It is intended to give the reader a sense of the impact imposed by visual impairments in the United States. This document is also available in an accessible format on our website at http://cosmos.ot.buffalo.edu/T2RERC/

Each entry in the Table of Contents has a specific intent. The document begins with a discussion of the **Anatomy and Physiology of the Eye**, intended to give the reader a clear understanding of the various parts of the eye and the functions that they control in the acquisition and processing of visual information. Following is a section on **Visual Assessment**, a compilation of various vision tests and reasons that they may be performed, methods of testing, and possible outcomes. The **Eye Care Professionals** section provides a breakdown of care providers who assist persons with visual impairments, and an explanation of the services that they are trained to offer.

The section on **Visual Impairments, Causes and Treatments** differentiates the major causes of adult blindness from the major causes of childhood blindness. It outlines symptoms, causes, and treatments for a number of visual impairments and provides information on prevalence. The section on **Demographics** gives a sense of how many people currently have specific limitations and thereby, how many may benefit from the development of a new technology.

The section on **Prevalence of Visual Impairment** in the United States provides an overview of the impact on Visual impairment in this country. **Market Growth** provides the reader with a sense of how prevalence numbers will change over the next thirty years.

The **Technologies** section outlines four categories of assistive technology utilized by persons with visual impairments: 1) technologies to assist with activities of daily living, 2) computer access technology, 3) access to graphics, and 4) wayfinding technology. It defines, provides examples of, and lists potential applications for each type of technology.

The section **Assessment of Needs** presents a delivery model of the steps involved in assigning an appropriate technology to an individual. **Legislation** presents recent developments regarding equal access for persons with visual impairments. The **Funding Sources** section outlines the types of funding available to persons with visual impairments. Also included is contact

information for a number of specific organizations, as well as a brief description of individual services offered by each **Source of Financial Aid for Eye Care**.

The various appendices of this document contain contact information for a wide range of manufacturers, related associations, and service providers. In addition, a listing of relevant publications is included to direct the reader to more comprehensive authorities on a number of subjects.

Executive Summary

The mission of the Rehabilitation Engineering Research Center on Technology Transfer (T^2RERC) is to improve the variety, quality, and choice of products available in the marketplace to benefit persons with disabilities. The Demand Pull Project fulfills this mission by addressing needs within a targeted market. The following areas have been the focus of earlier projects: wheelchair and scooter technology, hearing technology, and alternative and augmentative communication technology. Under the Demand-Pull Project on Technology for Visual Impairment an industry profile has been compiled to facilitate the development and introduction of new products into the marketplace to benefit people with blindness and low vision.

The Industry Profile provides a snapshot of the current state of practice in the field of visual impairment. We have included the most current data available. Please consider a few important points as you read through this document:

- A significant majority of the people who report visual impairments are over the age of 65.
- Only 10% of people with visual impairments are able to read braille (American Foundation for the Blind, 2003).
- There are an enormous amount of services and technologies in the United States for people who need them, yet many do not know they exist.
- Many service providers who work in the field of visual impairment are either not aware of or are not sharing vital information about assistive technologies that can positively impact the lives of their customers.
- Visual impairment is a growing concern in America as the number of people affected by vision loss continues to grow.
- New and innovative technologies that provide people with visual impairments with equal access to employment, education, and community are being introduced through technology transfer on a regular basis.

We thank everyone who has contributed to the research, with special thanks to the Smith-Kettlewell RERC for Blindness and Low Vision for their help. Within each project, the T^2RERC partners with the corresponding RERC and one of the six regions of the U.S. Federal Laboratory Consortium (FLC). The partner RERC has knowledge of relevant research and reference materials, consumer needs, and products in the marketplace. The collaborating FLC Region provides access to experts in core technologies. The partner organizations for the Demand-Pull Project on Technology for Visual Impairment are the Smith-Kettlewell RERC for Blindness and Low Vision, and the Far West Region of the Federal Laboratory Consortium.

Your comments and feedback are very welcome and will help us improve the quality and completeness of future profiles. Please forward any suggestions you may have to wstrobel@buffalo.edu.

Anatomy and Physiology of the Eye

Figure 1: Diagram of the human eye identifying the various segments described below.

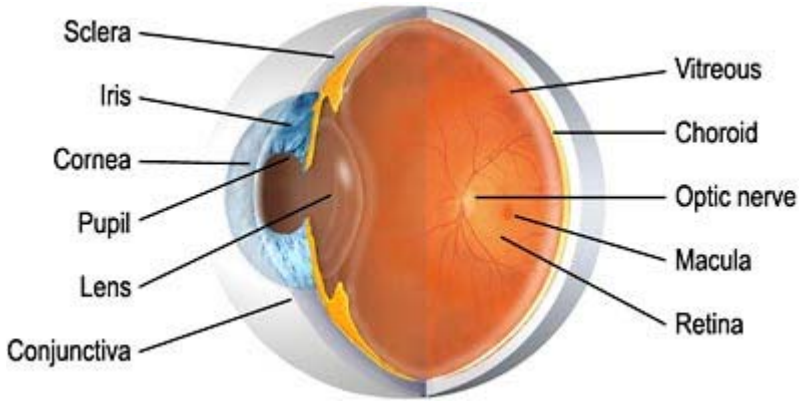


Illustration by Mark Erickson

The protective outer layer of the eye, sometimes referred to as the “white of the eye” is called the sclera and it maintains the shape of the eye. The front portion of the sclera, called the cornea, is transparent and allows light to enter the eye. The cornea is a powerful refracting surface, providing much of the eye's focusing power (Cassin and Solomon, 1997). Attached to the sclera are six extraocular muscles responsible for movement of the eyes (Bianco, 2002). The choroid is the second layer of the eye and lies between the sclera and the retina. It contains the blood vessels that provide nourishment to the outer layers of the retina (Cassin and Solomon, 1997). The iris is the part of the eye that gives it color. It consists of muscular tissue that responds to surrounding light, making the pupil, or circular opening in the center of the iris, larger or smaller depending on the brightness of the light (Pachler and Rizun, n.d.).

Light entering the pupil falls onto the lens of the eye where it is altered before passing through to the retina. The lens is a transparent, biconvex structure, encased in a thin transparent covering. The function of the lens is to refract and focus incoming light onto the retina for processing (Moorfields Eye Hospital, 2002).

The retina is the innermost layer in the eye. It converts images into electrical impulses that are sent along the optic nerve to the brain where the images are interpreted. The retina can be compared to the film of a camera. It is composed of light sensitive cells known as rods and cones interconnected by a complex mesh of neurons that provide early stage visual processing. Rod cells are primarily in the outer retina, do not discriminate colors, have low spatial resolution, support vision in low light (“night vision”), are sensitive to object

movement and provide peripheral vision. Cone cells are densely packed within the central visual field, function best in bright light, process acute images and discriminate colors (Montgomery, 2002).

The macula is located in the back of the eye, in the center of the retina. Within the macula is an area called the fovea centralis. This area contains the highest concentration of cones, produces the sharpest vision, and is used to see details clearly (Moorfields Eye Hospital, 2002).

The inside of the eyeball is divided by the lens into two fluid-filled sections. The larger section at the back of the eye is filled with a colorless gelatinous mass called the vitreous humor. The smaller section in the front contains a clear, water-like material called aqueous humor (Discovery Fund for Eye Research, 1999). A circular canal, called the Canal of Schlemm provides a drainage system for the aqueous humor from the eye into the bloodstream. Blockages in the Canal of Schlemm are believed to be contributing factors in the development of glaucoma (Bianco, 2002).

The conjunctiva is a mucous membrane that begins at the edge of the cornea and lines the inside surface of the eyelids and sclera, which serves to lubricate the eye. Inflammation of this membrane results in conjunctivitis, commonly known as pink eye (Bianco, 2002; Cassin and Solomon, 1997).

Vision Assessment

The Lighthouse International is a leader in the development of rehabilitation services, education, research, prevention and advocacy in visual impairment. They provide the following definition of visual impairment (2001):

> "Vision is a complex sense, encompassing the ability to perceive detail (acuity), color and contrast, and to distinguish objects. These capacities can diminish naturally with age. While most visual changes can be corrected by glasses, medicine or surgery, visual changes caused by eye disease, poor health, or injury can cause permanent vision loss. If the loss is total, the result is blindness. If it is partial, the result is a vision impairment known as "low vision." A person with low vision has severely reduced visual acuity or a significantly obstructed field of vision — or both."

Vision loss can occur in varying degrees in the following areas: (1) impairment to central vision resulting in blind spots, poor acuity and difficulty or inability to see fine detail and perceive color, (2) impairment of the cornea or lens resulting in blurred vision and sensitivity to glare, (3) impairment of peripheral vision leaving only the ability to see the center of the normal visual field (tunnel vision), thereby limiting the ability to perceive motion, see an entire picture at one time, and see in low light, (4) loss of vision in other parts of the visual field, including the left, right , upper or lower parts of the visual field, or (5) a combination of any of these condition.

Since vision changes can occur without notice, eye examinations are recommended on a regular basis. The minimum recommended frequency of examination for those at low risk for vision loss, as recommended by the Canadian Association of Optometrists (2003), is as follows:

- Infants and toddlers (birth to 24 months) – initial exam at or before 6 months of age
- Preschool (2 to 5 years) - at age 3, and prior to entering elementary school
- School age (6 to 19 years) - annually
- Adult (20 to 64 years) - every one to two years
- Older adult (65 years and older) - annually

A comprehensive eye examination evaluates general eye health and may result in a corrective lens prescription, if appropriate. A number of tests may be conducted to examine the external and internal parts of the vision system including the eyelashes, eyelids, conjunctiva, iris, lens, cornea, pupils, extra-ocular muscles, blood vessels, optic nerve and the retina. Vision problems including glaucoma, cataracts and corneal diseases, as well as ocular changes associated with diseases such as diabetes, high blood pressure and neurological

disorders will be assessed (EyeHealth Northwest, 2003). The following is a description of some common eye tests and procedures.

General Vision Tests

1. Visual acuity is tested by reading a Snellen eye chart at a distance of 20 feet. The eye chart is imprinted with block letters that decrease in size line-by-line, corresponding to the distance at which that line of letters is normally visible. Each line of the eye chart is assigned a fraction that represents visual acuity. The numerator is the distance in feet the patient is from the eye chart. The denominator represents the comparative distance (in feet) at which a normal sighted individual would identify this line (Saint Luke's Cataract and Laser Institute (St. Luke's), 2003). Anthropometric data has illustrated what eye doctors consider "normal" human vision. For example, if a person is said to have 20/20 vision, they are able to see what someone with "normal" vision can see at 20 feet away. Visual acuity of 20/40 means that the person being tested must be only 20 feet from the chart to be able to read it as well as someone with normal vision who is 40 feet from the chart. 20/200 means that the person being tested must be only 20 feet from the chart to be able to read it as well as someone with normal vision who is 200 feet from the chart.

2. Refraction is a vision test that determines best visual acuity achievable with corrective lenses. Information obtained from a refraction test forms the basis for individual eyeglass or contact lens prescription. Typically the test is performed using an instrument called a phoropter. The phoropter holds corrective lenses that are positioned in front of the eye. While looking at the eye chart through the phoropter, the examiner adjusts the lenses until the chart appears as clear as possible (St. Luke's, 2003). This test can determine if the person being tested has myopia, hyperopia, astigmatism or presbyopia.

3. A slit lamp is an examination device that consists of a moveable light source and binocular microscope. It enables the doctor to examine the eye under high magnification. The patient is seated and the head is stabilized by an adjustable chin rest and forehead strap. It is used to evaluate the anterior structures of the eye such as the lens, the iris and the cornea. When combined with special lenses, it easily adapts for examination of the posterior segment of the eye including the vitreous and back of the eye (Vaughan, Asbury, and Riordan-Eva, 1995).

5. Contrast sensitivity testing is a comprehensive measure of visual functioning. Contrast sensitivity refers to the ability of the visual system to distinguish between an object and its background. While visual acuity testing measures eyesight under the best possible conditions, it does not reflect the difficulties one might experience when driving at night or trying to read a street sign on a cloudy day. The patient is presented with a series of stripes or bars that slant in different

directions. They must identify which way each series of stripes is tilted. The bars then become lighter as the test continues. Individuals with good contrast sensitivity can determine the direction in which very light, thin bars are slanted (St. Luke's, 2003).

Glaucoma Tests

1. Fluid pressure inside the eye is called intraocular pressure (IOP). This is a balance, called tension, between the production and the drainage of the aqueous fluid inside the anterior chamber of the eye. It is measured with a procedure called tonometry. In the non-contact procedure, a puff of air is blown onto the eye and an instrument calculates pressure from the change in the light reflected off the corneas as the air puff is blown (Douglas, 2001). Elevated IOP can cause pressure within the eye to increase and damage the optic nerve. As abnormal pressures are often asymptomatic it is important to have the pressure checked regularly.

2. The visual field test is used to examine peripheral vision. It provides information related to neurological function of the retina, optic nerve, and brain. It is often used to monitor eye diseases such as glaucoma, and also as a screening prior to surgery. Visual field tests vary, but most have a white bowl with a small fixation light in the center and are often computerized. Patients are asked to stare straight ahead as tiny lights flash in the periphery and press a button each time a light appears. The computer analyzes the data and prints a chart that indicates where in the visual field the lights were seen (St. Luke's, 2003).

3. Gonioscopy is an eye examination used to evaluate the angle between the cornea and the iris using mirrors and a special lens called a"gonio lens" (Anard, 2003). This test indicates whether the area where fluid drains out of the eye is blocked or damaged in some way. Gonioscopy is often done as part of a complete glaucoma exam, and may also be routinely done if the patient is at risk for developing glaucoma (Spengler, 2002).

4. Over time, increased pressure in the eye can cause damage to the optic nerve (Saine, 1996). Fundus photography**,** a highly specialized form of medical imaging using a customized camera mounted to a microscope with mirrors and high-powered lenses, is used to document the health of the optic nerve, vitreous humor, macula, retina and its blood vessels (St. Luke's, 2003).

Retinal Tests

1. An ophthalmoscope is an illuminated instrument used to examine the internal structures of the eye including the retina and vitreous humor (Cassin and Solomon, 1997). Ophthalmoscopes can be direct or indirect. Direct ophthalmoscopes are hand-held instruments, about the size of a flashlight, with a battery powered light source. Rotating lenses incorporated in the instrument are

used to focus the examiner's field of view on the retina. The direct ophthalmoscope is useful for examining the central retina. With the indirect ophthalmoscope technique, the examiner wears an instrument on the head that resembles a miner's light. A larger area of the retina can be viewed with an indirect ophthalmoscope (Medline Plus, 2003).

2. The Amsler Grid is a screening test used for detecting central visual field distortions that occur in macular diseases such as macular degeneration. It consists of evenly spaced horizontal and vertical lines printed on black or white paper that form a grid. In the center of the grid is a dot that the patient focuses on, one eye at a time. If the lines of the grid do not appear straight and parallel or areas appear to be missing, it is an indication that further examination of the macula is needed (St. Luke's, 2003).

3. Fluorescein angiography (FA) is a test used to determine if there is proper circulation in the retinal blood vessels. Fluorescein dye is injected, usually in a vein in the arm, and then a series of rapid photographs of the back of the eye are taken as the dye circulates (Cassin and Solomon, 1997). This test is useful for evaluating many eye diseases that affect the retina.

4. An Indocyanine Green study (ICG) is a special dye test used to evaluate the circulatory system of the choroid, the layer just behind the retina. The test is administrated in a manner similar to the Fluorescein angiography, however, it differs in that ICG allows the examiner to view circulatory "leaks" under a layer of blood vessels which is not possible with fluorescein angiography (Cassin and Solomon, 1997).

5. Ophthalmic ultrasound is the transmission of high frequency sound waves into the eye which are reflected by the tissue and displayed on a screen (Cassin and Solomon, 1997). This non-invasive test is used to estimate eye structure dimensions, document pathology such as tumors, and examine the inside of the eye. The sound frequency emitted from the probe determines the type of image formed on the screen.

Corneal Tests

1. Corneal topography is used to examine the curvature of the cornea. A device called a "corneal topographer" projects a series of illuminated rings onto the corneal surface. The rings are then reflected back and analyzed by a computer which generates a colored topographical map of the cornea. This map is useful in evaluating astigmatism, monitoring corneal disease and as a diagnostic procedure for patients being considered for refractive surgical procedures, such as Laser-Assisted *In Situ* Keratomileusis (LASIK) (EyeMDLink.com, 2003).

2. Keratometry also measures the corneal curvature. However, rather than mapping the entire surface as corneal topography does, it measures only the flattest and the steepest curves, called the "flattest meridian" and the "steepest

meridian." Unequal meridional powers indicate astigmatism (Cassin and Solomon, 1997). These two measurements provide the examiner with information related to distortions in the cornea's focusing power and are helpful for fitting contact lenses and monitoring the curvature of the cornea following surgery (St. Luke's, 2003).

3. The pachymeter is a device that measures the thickness of the cornea using ultrasound (WebEyeMd.com, 2003). It is useful in monitoring the progression of certain disorders that cause the cornea to become thickened resulting in vision loss. Pachymetry is also an essential measurement prior to certain refractive surgical procedures, such as LASIK which remove tissue from the cornea (St. Luke's, 2003).

4. Corneal and conjunctival dryness can be caused by low tear production The Schirmer Test is one test that is used for measuring the production of tears. Small paper strips are placed in the lower lids and removed after a few minutes. The moist parts of the strips are then measured (Cassin and Solomon, 1997).

5. Specular endothelial microscopy is a test that uses a microscope and a camera to examine and photograph the size and regularity of endothelial cells that line the back of the cornea. It is useful in calculating the risk to the cornea during cataract removal (Cassin and Solomon, 1997).

Tests for Eye Alignment

1. Prism testing. A prism is a transparent, wedge-shaped optical device that bends (refracts) light rays (Cassin and Solomon, 1997). This light-bending property can be used to detect and measure strabismus (turned or crossed eye) by changing an object's apparent position. The patient stares at an object, and prisms of increasing strength are placed over the misaligned eye until its focus is aligned with the other eye. The stronger the prism required to align the eyes, the greater the measurement of eye turn (St. Luke's, 2003).

2. Pupil light reflex tests are performed to determine if the eyes are aligned and share a common point of focus. These tests are done by shining a bright light into the patient's eyes and the light location on the pupils. If the eyes are properly aligned, light reflects in the center of the pupils. When the eyes are not aligned, light reflection is not centered in one pupil (Hartford Hospital Eye Institute, 2003).

3. Stereopsis testing is conducted in order to determine a person's ability to use stereo vision or stereoscopic vision (Fisher, 2003). Stereoscopic vision allows an individual to determine the location of an object in space in relation to his/her person. In other words stereoscopic vision is necessary for depth perception. The stereopsis test checks for the presence of binocular vision impairments (i.e. Amblyopia and Strabismus) which affect nearly 12% of the population (Optometrist Network, 2003). During a stereopsis test, the patient wears special

polarized glasses while looking at a series of objects presented in 3-D. The person is asked to determine which of the images have the greatest three dimensional effects (St. Luke's, 2003).

4. Worth-4 Dot Test also tests depth perception. In this test, the patient wears glasses with one green lens and one red lens while looking at a target with 4 different colored dots or lights. The patient is asked how many dots or lights they can see. The number and the color of the dots or lights seen helps the examiner determine if there is normal perceptual blending of similar images or if one eye is suppressing or ignoring an image (St. Luke's, 2003).

Eye Care Professionals

There are several types of eye care professionals as defined below by the appropriate eye care professional organization.

Ophthalmologist
From the American Academy of Ophthalmology (2003a):

> "An ophthalmologist is a physician (doctor of medicine or doctor of osteopathy) who specializes in the refractive, medical and surgical care of the eyes and visual system and in the prevention of eye disease and injury. The ophthalmologist has completed four or more years of college premedical education, four or more years of medical school and four or more years of residency, including at least three years of residency in ophthalmology. The ophthalmologist is a specialist who is qualified by lengthy medical education, training, and experience to diagnose, treat, and manage all eye and visual system problems and is licensed by a state regulatory board to practice medicine and surgery. The ophthalmologist is the medically trained specialist who can deliver total eye care: primary, secondary and tertiary care services (i.e., vision services, spectacle and contact lens prescriptions, eye examinations, medical eye care and surgical eye care), diagnose general diseases of the body and treat ocular manifestations of systemic diseases."

Optometrist
From the American Optometric Association (2004a):

> "Doctors of optometry are independent primary health care providers who examine, diagnose, treat and manage diseases and disorders of the visual system, the eye and associated structures as well as diagnose related systemic conditions. Optometrists examine the internal and external structure of the eyes to diagnose eye diseases like glaucoma, cataract and retinal disorders; systemic diseases like hypertension and diabetes; and vision conditions like nearsightedness, farsightedness, astigmatism and presbyopia. Optometrists also do testing to determine the patient's ability to focus and coordinate the eyes, to judge depth, and see colors accurately. They prescribe eyeglasses and contact lenses, low vision aids, vision therapy and medicines to treat eye diseases.
>
> As primary eye care providers, optometrists are an integral part of the health care team and an entry point into the health care system. They are skilled in the co-management of care that affects the eye

health and vision of their patients and an excellent source of referral to other health care professionals.

The optometrist has completed pre-professional undergraduate education in a college or university and four years of professional education at a college of optometry, leading to the doctor of optometry (O.D.) degree. Some optometrists complete a residency."

Optician

From Opticians Association of America (2001):

> "An optician manufactures, verifies, and delivers lenses, frame and other specially fabricated optical devices. The optician's functions include; prescription analysis and interpretation, determination of the lens forms best suited to the wearer's needs; the preparation and delivery of the work orders for grinding of lenses and the fabrication of eyewear; the verification of the finished ophthalmic products; the adjustment, replacement, repair and reproduction of previously prepared ophthalmic devices."

Low Vision Specialists

According to the Lighthouse International, Low Vision Specialists are ophthalmologists and optometrists who specialize in evaluating and prescribing low vision devices for individuals with low vision. Low Vision Specialists conduct a Low Vision Exam as defined below by the American Optometric Association (2004a):

> "The optometrist providing low vision rehabilitation will ask for a complete personal and family general health and eye health history. In addition, the optometrist will discuss the functional problems with the patient, including such things as reading, functioning in the kitchen, glare problems, travel vision, the workplace, television viewing, school requirements, and hobbies and interests.
>
> Preliminary tests may include assessment of ocular functions such as color vision and contrast sensitivity. Measurements will be taken of the person's visual acuity using special low vision test charts, which include a larger range of letters or numbers to more accurately determine a starting point for determining the level of impairment. Visual fields may also be evaluated. A specialized refraction must be performed and each eye will be thoroughly examined.

> The optometrist may prescribe various treatment options, including low vision devices, as well as assist the person with identifying other resources for vision and lifestyle rehabilitation."

Additional Rehabilitation Professionals

Individuals with a vision loss need to learn skills and strategies to function as independently as possible in activities of daily living, maintaining or acquiring new vocational skills, and navigating within different environments. They may also need to learn how to use low vision and/or assistive technology devices. This adjustment process, as well as the provision of low vision services, is known as vision rehabilitation (Lighthouse International, 2001). Vision rehabilitation is often provided by a team of professionals that may include one or more of the following as defined by the appropriate organization.

Assistive Technology Service Providers

Assistive Technology Service Providers are individuals who are knowledgeable in the area of assistive technology and who provide direct service to consumers. These individuals may be credentialed by a number of organizations including the Rehabilitation Engineering and Assistive Technology Society of North America (RESNA). The following is the definition of Assistive Technology Service Providers as defined by RESNA (2004):

> "Assistive Technology Service providers are individuals who are involved in analysis of a consumer's needs and training in the use of a particular device"

Occupational Therapists

From the American Occupational Therapy Association (2002):

> "Occupational therapy practitioners are skilled professionals whose education includes the study of human growth and development with specific emphasis on the social, emotional, and physiological effects of illness and injury. "

Orientation and Mobility Specialists

From the Academy for Certification of Vision Rehabilitation and Education Professionals (2000a):

> "Certified Orientation and Mobility Specialists (COMS) provide sequential instruction to individuals with visual impairment in the use of their remaining senses to determine their position within the environment and in techniques for safe movement from one place to another. The skills involved in this instruction include but are not limited to:

- concept development, which includes body image, spatial, temporal, positional, directional and environmental concepts;
- motor development, including motor skills needed for balance, posture, and gait, as well as the use of adaptive devices and techniques to assist those with multiple disabilities;
- sensory development, which includes visual, auditory, vestibular, kinesthetic, tactile, olfactory, and proprioceptive senses, and the interrelationships of these systems;
- residual vision stimulation and training;
- human guide technique;
- upper and lower protective techniques;
- locating dropped objects;
- trailing;
- squaring-off;
- cane techniques;
- soliciting/declining assistance;
- following directions;
- utilizing landmarks;
- search patterns;
- compass directions;
- route planning;
- analysis and identification of intersections and traffic patterns;
- use of traffic control devices;
- techniques for crossing streets;
- techniques for travel in indoor environments, outdoor residential, small and large business districts, mall travel, and rural areas;
- problem solving;
- use of public transportation;
- evaluation with sun filters for the reduction of glare; and
- instructional use of low vision devices."

Rehabilitation Counselors

From the Council of State Administrators of Vocational Rehabilitation (2002):

> "Rehabilitation counselors provide individualized services to maximize the employability, independence, and integration of people with disabilities into the workplace by ensuring informed choice and facilitating client empowerment. Typical services include assessment of rehabilitation needs, development of an individualized plan to meet those needs, coordination of the array of services, job placement, and follow-up to assure that the goal was achieved.
>
> The rehabilitation counselor is the central professional responsible for the delivery of rehabilitation services to persons with disabilities

and the primary fiscal agent responsible for expenditure of tax funds in the rehabilitation process.

Rehabilitation Teachers
From the Academy for Certification of Vision Rehabilitation and Education Professionals (2000b):

> "Rehabilitation teachers instruct persons with vision impairments in the use of compensatory skills and assistive technology that will enable them to live safe, productive, and independent lives. Rehabilitation teachers work in areas that enhance the vocational opportunities, independent living, and educational development of persons with vision loss, and may include working in center-based or itinerant settings.

Specific areas of instruction taught by rehabilitation teachers include:

1. Communication systems including braille, handwriting, recording skills, use of electronic reading systems, use of assistive technology and computer access technology, etc.
2. Personal management including grooming, hygiene, clothing organization, medical measurement, socialization skills, etc.
3. Home management including organization and labeling, repair and home maintenance, budgeting and record keeping, etc.
4. Activities of daily living including cooking, cleaning, shopping, safety, money organization and management, etc.
5. Leisure and recreation activities including hobbies, woodworking, crafts, sports, etc.
6. Psycho-social aspects of blindness and vision loss.
7. Medical management of visual impairment including assessment and instruction and training of adaptive medical equipment.
8. Basic orientation and mobility skills including sighted guide, safety techniques, etc."

Teachers of the Visually Impaired (TVIs)
From the Rehabilitation Research and Training Center on Blindness and Low Vision (2002):

> "Most TVIs work as itinerant teachers serving children who are blind or visually impaired in mainstreamed school settings. TVIs also work with infants and preschool children in home and/or school settings. The primary focus of instruction is on teaching compensatory skills including pre-braille and braille Instruction, communication skills, and study skills. In addition, TVIs consult with regular classroom teachers on methods that enhance the acquisition of knowledge usually acquired from visual means. TVIs

provide functional vision evaluations and other educational assessments, write educational plans, work with families and ensure the acquisition of educational materials in accessible media."

Visual Impairments, Causes and Treatments

Definitions of Terms Related to Blindness and Visual Impairment

Visual impairment is a term used by researchers that refers to a "functional loss of vision" (National Dissemination Center for Children with Disabilities (NICHCY), 2003). This term is generally not used as a clinical reference because of a lack of specificity regarding the intensity of impairment. Visual disabilities occur at varying degrees, dependent upon the level of disability and the cause of the impairment. Prevent Blindness America (Shoemaker, 2002) defines visual impairment as vision of 20/40 or less in the better eye with corrective lenses or a visual field of less than 20 degrees diameter. Various estimates for the total number of people in the U.S. with visual impairments are included in the demographics section of this document.

Low vision is a clinical diagnostic term that refers to vision in the range of 20/70 to 20/160 (American Optometric Association (AOA), 2004a). People with low vision often retain some portion of usable vision and are able to make use of assistive technology devices to perform activities of daily living (National Advisory Eye Council, 1998).

Severe visual impairment is primarily used to describe vision loss in the range of 20/200 to 20/400 (AOA, 2004a). The definition of severe visual impairment varies widely between studies. However, as the level for diagnosis for legal blindness is 20/200 or a visual field of less than 20 degrees, many of the people within this category may be labeled legally blind.

Legal blindness refers to a diagnosis of 20/200 or a visual field of less than 20 degrees. While the term "legally blind" has no medical significance it does mark an entry point for many low vision services and benefits. Therefore, it is an important distinction to note (Shoemaker, 2002).

The AOA (2004a) includes other levels of visual impairment including **profound low vision** at 20/500 to 20/1,000. Acuity levels of less than 20/1000 generally qualify as near total blindness. **Total blindness** is considered to be present when there is no light perception (AOA, 2004a; Shoemaker, 2002).

Common Eye Problems

There are many eye diseases and dysfunctions that can lead to visual impairment. The most commonly found disorders are myopia (near sightedness) or hyperopia (far sightedness). **Myopia**, which results from elongation of the eyeball, causes the image to fall in front of the retina instead of on its surface. Myopia affects approximately one-third of the American population. When an

individual is nearsighted they have difficulty seeing objects at a distance, tasks that require near vision are unaffected. **Hyperopia** is caused by a slightly shortened eyeball that causes images to focus slightly behind the retina. Hyperopia affects vision for close tasks. It is estimated that one-fourth of Americans have hyperopia. **Presbyopia**, which generally affects people over 40, is believed to be caused by a hardening of the lens within the eye that makes it difficult to focus on objects that are close to the person's eyes (Lee and Bailey, 2000). Common corrections for myopia, hyperopia, and presbyopia are corrective lenses or glasses. An astounding 150 million Americans spend $15 billion per year on corrective lenses supporting a $30 billion optical industry (Shoemaker, 2002). Many Americans are beginning to turn to surgery to correct both myopia and hyperopia.

Visual Impairment in Adult Populations

Glaucoma is a disease of the eye that is caused by a gradual degeneration of cells in the optic nerve. The loss of these cells leads to a gradual narrowing of the field of vision beginning at the periphery (Shoemaker, 2002).There is no known cause for the most common form of glaucoma, primary open angle glaucoma, but it is commonly believed to be associated with the inability of fluid to properly drain from the eyes causing an increased intraocular pressure (National Eye Institute (NEI), 2003). Primary open angle glaucoma affects more than 2.2 million people, ages 40 and over in America alone (Shoemaker, 2002). Ritch (2000) emphasizes the point that glaucoma does not result from a single eye disease that can be treated by simply relieving intraocular pressure, but is a "final, common pathway of many diseases that affect the eye." Onset generally occurs later in life and people over 60 are six times more likely to get glaucoma than the younger population (Glaucoma Research Foundation (GRF, 2003). In some cases **congenital glaucoma** will be found in children as young as two and three. Not only do these children experience more signs and symptoms of eye disease, but these cases directly relate to an inability of fluid to drain from the eye (McLeod, Wisnicki, and Medow, 2000). Glaucoma is the leading cause of blindness among African-Americans, and Hispanic Americans over the age of 60 are also at an increased risk. Common symptoms include elevated inter-ocular pressure, optic disk cupping, and visual field loss (Shoemaker, 2002). Often people will lose vision from primary open angle glaucoma with little warning or noticeable symptoms (GRF, 2003). Major risk factors include advanced age, African or Hispanic descent, heredity, and prolonged smoking or steroid usage (Weih, Nanjan, McCarty, and Taylor, 2001; Liebmann, 2003; GRF, 2003). While there is no way to prevent glaucoma, it can be successfully treated if diagnosed early.

Age-related macular degeneration (MD) is caused by the malfunction of photosensitive cells in the macula which results in a loss of the central field of vision (Macular Degeneration Foundation, 2003). The Royal National Institute of the Blind (2002a) reports that additional symptoms may include a distortion of

images especially at the center of the visual field; a darkened area in the center of an image; and diminished color perception. The peripheral vision of people with macular degeneration is unaffected. Although the disease affects nearly 1.7 million Americans over the age of 50, and is the leading cause of blindness in developing countries, no exact cause is known (Shoemaker, 2002; Schwartz, 2000). In rare cases, **juvenile MD** occurs as a result of mutated genes and is generally an inherited condition (MDF, 2003). Dry MD is the most common form of the disease, totaling approximately 85% to 90% of all cases. It is related to the development of drusen, or small yellow fat deposits, under the macula. These deposits cause the macula to thin and dry out which relates directly to the loss of vision (American Macular Degeneration Foundation (AMDF), 2003). There is no known treatment or cure for dry MD. Wet MD accounts for approximately 10% of all cases of MD in older Americans. It is caused by the growth of new blood vessels that bleed and leak fluid into the macula causing distorted vision and the formation of scar tissue (Shoemaker, 2002; AMDF, 2003). Laser therapy is often used as a treatment in wet MD, but this intervention does not guarantee that vision will be saved.

Optic nerve atrophy (ONA) is caused by tissue damage in the optic nerve resulting in either partial or profound loss of vision (Douglas, 2002). The causes of ONA vary widely. The most common type, ischemic optic neuropathy, most often impacts elderly Americans and is estimated to affect between 6,500 and 29,000 people in the United States. Arteric optic neuropathy, which is caused by poor blood flow to the optic nerve, affects approximately 1,000 people in the United States (Younge, 2001). In adults, ONA can be caused by trauma, toxic substances, radiation, and shock. Disease related causes include multiple sclerosis, brain tumor, or stoke (Douglas, 2002). In children, ONA is commonly caused by anoxia, tumors, hydrocephalus, heredity, and rare degenerative disorders (Blind Babies Foundation, 2002). Optic nerve atrophy reduces central vision acuity resulting in an inability to see detail. It also reduces the field of vision, causing images in the periphery to be lost. Finally, there will be a decreased reaction of the pupil to light sources. As ONA progresses, the pupil will cease to react to light altogether (Douglas, 2002). Once vision is lost through ONA, it cannot be recovered.

Diabetic Retinopathy is a disease of the eye that all people with diabetes should be aware of. It is a visual disorder associated with diabetes that causes retinal blood vessels to leak into the retina causing macular edema. In the advanced stages, called the proliferative stage, new blood vessels grow along the retina and into the vitreous humor (Shoemaker, 2002; National Eye Institute (NEI), 2000). It is estimated that nearly 5.4 million Americans, ages 18 and over currently have diabetic retinopathy. It causes over 8000 cases of new blindness annually, and is the primary cause of blindness for people ages 25 to 74 (Valero and Drouilhet, 2001). Vision loss from diabetic retinopathy generally worsens over time. It will begin with a blurring of the vision and as it develops will cause development of cloudy vision, blind spots, or floaters (Access Media Group,

2002)**.** Careful control of diabetes and regular eye exams can delay the development of the disorder (Eyes on Diabetes, 2004). While diabetic retinopathy will often develop with no pain and minimal symptoms in its early states, it can be treated if it is diagnosed early. Photocoagulation is a treatment option for people with diabetic retinopathy. Photocoagulation is a laser surgery that is used to destroy leaking blood vessels that lead to macular edema (Shoemaker, 2002). In cases when the vitreous humor fills with blood, a virectomy is performed to remove the liquid and replace it with a salt solution (NEI, 2000).

Retinitis Pigmentosa (RP) is a progressive disorder that results from the degeneration of photoreceptor cells (rods and cones) of the retina. As these cells degenerate, gradual vision loss occurs. The disease often first occurs in adolescence and continues to progress as the individual ages often resulting in blindness in young adults. RP is a genetic disorder that is linked to more than 70 different genetic defects (de Beus and Small, 2003). Retinitis pigmentosa affects 50,000 to 100,000 people in the United States, making it a relatively rare disorder (Healthcommunities.com, 2004). In cases where the rod cells are primarily affected, vision loss generally begins as night blindness and progressive vision loss in the periphery results in tunnel vision (Foundation for Fighting Blindness (FFB), 2003). Another form of RP, known as rod-cone dystrophy is associated with loss of central vision and color perception. RP is caused by a group of hereditary disorders that include Usher's syndrome, Leber's congenital amaurosis, choroideremia, Laurence-Moon syndrome, and Best syndrome. There is no known cure for RP, although Vitamin A is said to slightly slow progression (FFB, 2003).

Cataracts result from a clouding (opacification) of the normally slightly yellowish lens of the eye (NEI, 2003). The loss of transparency causes light to be diffused as it enters the eye which impacts the clarity of the visual image (Chylack, 2000). The lens slowly develops a greenish and later a brownish tint which impedes the ability of light to pass through the lens (Mayo Foundation, 2002). Symptoms of cataract include blurred vision, light sensitivity, double vision, and an apparent fading or yellowing of colors. Night vision is generally impacted as is the amount of light needed to complete near tasks (American Academy of Ophthalmology (AAO), 2003b). While the most common cataracts are age-related, there are other types of cataracts, including secondary cataracts (resulting from other diseases, such as glaucoma or diabetes); traumatic cataracts (which may develop as a result of injury to the eye); or radiation cataracts (which develop as a result of exposure to radiation) (AAO, 2003b). Congenital cataracts, a very common cause of blindness in the pediatric population, can result in bilateral vision impairment if not treated meticulously (McLoed, Wisnicki, and Medow, 2000). Additional risk factors include prolonged use of corticosteroids, excessive consumption of alcohol, smoking, and excessive exposure to sunlight (Mayo Foundation, 2003). Many people develop cataracts as a result of the normal aging process. In the United States, cataract surgery is an outpatient procedure that replaces the damaged lens of the eye with an intraocular lens (Chylack,

2000). This surgery is performed on approximately one half of a million people each year (Annis, 2000). According to Chylack (2000) cataract surgery is the first line item in Medicare budget as it is a very common surgery for people over the age of 65. Medicare's administrative bodies are attempting to reduce the amount of reimbursement allowed to doctors and hospitals for performing cataract surgery (Annis, 2000).

Pediatric Visual Impairment

While many older Americans experience visual impairment at a greater rate than people under the age of 50, pediatric visual impairments, including those listed above, affect America's young. The primary causes of visual disability for children in the United States include cortical vision impairment, retinopathy of prematurity, and hypoplasia (McLeod, Wisnicki, and Medow, 2000).

Cortical vision impairment (CVI), also known as neurological vision impairment, results from brain dysfunction in the posterior visual pathways which impair the brains ability to translate what the eyes see (Palmer, n.d.). The causes of CVI are traumatic incidents, either within the womb or shortly after birth, including hypoxia, ischemia, head injury, hydrocephalus, meningitis, and encephalitis (Blind Babies Association of America, 1998). In some cases, children who have neurological vision impairment may experience improvement to the vision as they age; others will not noticeably improve (Better Health, 2003; Blind Babies Association of America, 1998). Many children with CVI will have normal pupilary reactions and normal eye movements with little or no visual response. CVI is a visual disability with many contradictory elements. Some children with CVI are photophobic while others seek out sources of bright light. Bright lights and shiny moving objects will often catch the eye of children with CVI, as color vision is often not affected by the disability. The vision of children with CVI may appear improved if either the child or the object they are looking at is moving (Blind Babies Association of America, 1998). Others who appear to be blind can move easily about an unfamiliar environment without bumping into things, this may be associated with a phenomenon known as blindsight. [Note: Blindsight relates to a persons ability to intuit where objects in the environment are without the ability to actually see those objects (Serendip, n.d.)]. Children with CVI are also said to be sensitive to visual over-stimulation that manifests itself as a short visual attention span (Blind Babies Association of America, 1998; Palmer, n.d.). The presence of a cortical visual impairment does not correlate with the cognitive ability of the child (Palmer, n.d.).

Retinopathy of prematurity (ROP) is a severe visual impairment that is directly related to premature birth and birth weight of the child. Infants who are born prematurely (under 32 weeks gestation) who have birth weights below 1250 grams (or 2.75 pounds) are at the greatest risk of developing significant vision loss as a result of ROP (NIH, 2003). Windsor and Windsor (n.d.) state that the final twelve weeks of gestation constitute a critical phase in the development of

the eyes of the fetus. When that development phase is eliminated or reduced, retinal blood vessels do not form properly leading to the development of ROP. In fact, ROP is caused by the abnormal growth of blood vessels in the retina that may cause "vascular proliferation, scarring, retinal detachment and blindness" in severe cases (National Library of Medicine, 2002). While estimates of the number American-born premature infants who are affected by ROP vary, it is projected to be between 250 to 500 new cases of severe vision impairment each year. Another 14,000 to 16,000 are affected to a lesser extent by ROP (NIH, 2003). The progression of ROP has been classified into five stages. Hartmann (2000) lists the following five stages:

- Stage 1 is marked by the creation of a demarcation line that separates affected and unaffected portions of the retina;
- Stage 2 is marked by a demarcation line that extends outside of the retina forming a ridge of abnormal blood vessels;
- Stage 3 (threshold disease) is marked by the existence of extraneous tissue that forms a ridge of fibrovascular tissue that extends into the vitreous humor;
- Stage 4 is marked by all of the symptoms present in stage 3 with some retinal detachment; and
- Stage 5 is marked by total detachment of the retina.

As many as 85% of ROP cases in stages one and two will require no intervention. In some cases, other vision impairments, such as cataract and glaucoma will develop in these children. They may also be at a greater risk for developing strabismus (crossed eyes), amblyopia (lazy eye), myopia (near sightedness), or anisometropia (differences in refractive errors between eyes) (McLeod, Wisnicki, and Medow, 2000). Premature infants with more advanced cases of ROP will require surgical intervention. Infants in stage 3 will often require treatments including cryotherapy or laser therapy that slow the growth of the abnormal blood vessels. As a consequence of this treatment, there may be a reduction of peripheral vision while the central vision is maintained. (NIH, 2003). In stages four and five, children may undergo a procedure known as scleral buckling. Scleral buckling is a procedure that uses an absorbable implant to reattach the retina after detachment has occurred (Windsor and Windsor, n.d.; Zmed, 2003). The success rate of scleral buckling is estimated at 70% retinal reattachment (The Association of Retinopathy of Prematurity and Related Diseases (ROPARD), 2004). Virectomy, which calls for the surgical removing of the vitreous, is performed only in stage five (Moss, 1998; St. Luke's, 2003) and has a success rate of approximately 76% (ROPARD, 2004). Generally speaking, some visual impairment remains after the performance of scleral buckling and virectomy. ROPARD (2004) lists visual impairment ranges of 10/60 to 20/300 for 15% of eyes, 20/60 to 20/800 for 30% of eyes, and 20/60 to 20/1900 for 48% of eyes. Light perception is maintained in 72% of cases.

Optic nerve hypoplasia (ONH) is the most common congenital defect of the optic nerve. It is marked by a diminished optic nerve, in which ten to ninety percent of the 1.2 million fibers that make up the optic nerve may be missing (Neville Clarence Technologies, 1998). The nerve itself will appear pale with a "circumscribed yellow-white ring" surrounding the nerve (McLeod et al, 2000). Hypoplasia causes a disruption in the optic nerves ability to transmit visual signals to the brain for processing (Verderber, 1996). ONH is very often accompanied by midline defects in brain development; pituitary dysfunction; and porencephaly (which is characterized by cysts or cavities in the surface of the brain (National Institute of Neurological Disorders and Stroke, 2002)). In some cases the mother may have contracted a gestational disease. Major gestational diseases include intrauterine growth retardation, pre-term labor, pre-eclampsia, chromosomal disorders, gestation diabetes and trophoblastic disease (Page, Kemp, Butlin, and Lowry, 2002). The cause of hypoplasia is not known, but it is thought to be associated with excessive alcohol intake during pregnancy, drug use (especially cocaine and LSD), and maternal infection (McLeod et al, 2000). ONH is non-progressive and vision impairment can range from no impairment to total blindness. There is no known cure for ONH (Sowka, Gurwood, and Kabat, 2001; Neville Clarence Technologies, 1998).

Demographics

Statistics regarding visual impairments in the U.S. are relatively easy to find, but difficult to analyze. Various agencies report statistics that are based on national datasets. Unfortunately, differences in survey designs alter the selection criteria, thereby producing conflicting results. Studies often exclude children; some change the definition of "visual impairment," and others modify their methodology from year to year. Studies also vary in their inclusion of institutionalized populations (i.e. nursing home residents), military personnel or non-resident U.S. citizens. A comprehensive analysis of these various reports is required in order to create an accurate depiction of the magnitude of visual impairment in the U.S. This demographic summary attempts to explain the differences found in commonly reported totals by presenting the variations in methodology that are unique to each study.

National Health Interview Survey

The National Health Interview Survey is an annual longitudinal survey conducted by the National Center for Health Statistics. Self reporting methods are used in information gathering. This survey includes only the residential civilian (non-institutionalized, non-military) population of the United States. The National Center for Health Statistics changed its survey methods in 1995 creating problems in the long-term analysis of data. The changes mainly concerned the samples from which the data was obtained, rather than the tool used to collect the data (Adams, Hendershot, and Marano, 1999).

According to the 1994 National Health Interview Survey, 8.6 million people in the U.S. have a chronic visual impairment (Adams and Marano, 1995). "Chronic" was defined as impairment in vision lasting 3 months or longer. "Visual impairment" was defined as "any trouble seeing with one or both eyes, even when wearing glasses". The 1996 estimates, which used the same definitions as the 1994 study show that 8.2 million Americans had a visual impairment (Adams, Hendershot, and Marano, 1999).

The National Center for Health Statistics separately publishes a report on nursing homes in the U.S. The National Nursing Home Survey (1997) was the fifth in their series. It collected data from a representative sample of U.S. nursing facilities that have three or more beds. This survey reported 420,300 residents were visually impaired; with 98,700 reporting a severe visual impairment, and another 39,400 reporting a complete loss of vision (Garbrel and Jones, 2000).

Survey of Income and Program Participation

The U.S. Census Bureau reports disability data collected by the Survey of Income and Program Participation (SIPP). The disability data provided by this study is topical, rather than core, meaning that it is collected in waves that are not necessarily consistent from year to year. The study also uses self-reporting methods, collecting data from the civilian non-institutionalized population. The survey was redesigned in 1996.

Data from the 1994 - 1995 survey includes people 6 years of age and older, and states that there were 8.8 million people who had “difficulty seeing the words and letters in ordinary newspaper print even when wearing contact lenses or glasses, if they usually wear them”; 1.6 million of the individuals reporting were “unable to see the words and letters in ordinary newsprint at all” (McNeil, 1997).

The 1997 SIPP data states that there were approximately 7.7 million people over the age of 15 who had “difficulty seeing the words and letters in ordinary newsprint even when wearing glasses or contact lenses”. 1.8 million of the people who responded were classified as having a “severe” impairment (unable to see the words and letters in ordinary newsprint even when wearing glasses or contact lenses), and the remaining 5.9 million were classified as “not severe”. Additionally, 264,000 children under the age of 15 had difficulty seeing the words and letters in ordinary newsprint, 45,000 of these children were reported as having a “severe” impairment (McNeil, 2001).

Vision Problems in the U.S.

Prevent Blindness America, in conjunction with The National Eye Institute, published Vision Problems in the U.S. which estimates the prevalence of visual impairment among adults 40 years of age and older in the United States. The 2000 report synthesized and analyzed data from 12 previously conducted studies from around the world in order to create an accurate depiction of vision problems in the United States.

According to this report, there are approximately 3.4 million people in the U.S. aged 40 and over who have a visual impairment, which is defined as “difficulty seeing with one or two eyes even when wearing glasses”. Additionally, there are 1 million people who are legally blind, which is defined as “visual acuity with best correction in the better eye worse than or equal to 20/200 or a visual field extent of less than 20 degrees in diameter (Shoemaker, 2002).”

Lighthouse National Survey on Vision Loss

Lighthouse International conducted a telephone survey on visual impairment in 1994 with the assistance of Louis Harris and Associates. The study was intended to reflect the impact of vision impairment in the U.S. for individuals aged 45 and over. The criteria for determining level of impairment are as follows:

- A person with a visual impairment:
  - would be unable to recognize a friend from across a room, even when wearing glasses;
  - not be able to read regular newspaper print, even when wearing glasses;
  - report their own vision as poor or very poor;
  - report some other trouble seeing, even with glasses; or
  - be blind in one or both eyes.
- A person with a severe visual impairment:

    - cannot recognize a friend at arms length even when wearing glasses or contact lenses;
    - cannot read ordinary newspaper print even when wearing glasses or contact lenses;
    - reports poor or very poor vision even when wearing glasses or contact lenses; or
    - is blind in both eyes.
- A person with a moderate impairment:
    - cannot recognize a friend across a room (but can recognize them at arm's length;
    - has any other trouble seeing even when wearing glasses or contact lenses and is not otherwise severely impaired; or
    - is blind in one eye.

Based on these definitions, the findings of this study indicate that 13.5 million Americans report some form of vision impairment; with 6.3 million people reported as moderately impaired; and the remaining 7.2 million people reported as severely impaired. Approximately 2 million people categorized as having a severe visual impairment report that they are totally blind (Lighthouse Inc, 1995).

Comparing Data Across Reports

Table 1 summarizes the total numbers across the four studies. The design variations between surveys make it difficult – even today – to accurately assess the number of people with visual impairments.

Table 1- Comparison of Total Numbers of People with Visual Impairments in the U.S.

Study (year)	Visual Impairment	Severe Visual Impairment or Blind
Lighthouse National Survey (1994)	13.5 million	7.2 million
National Health Interview Survey (1996)	8.2 million	N/A
Survey of Income and Program Participation (1997)	7.7 million	1.8 million
Vision Problems in the U.S. (2000)	3.4 million	1 million

Some states currently operate registries for the blind and visually impaired. For example, Indiana's State Department keeps record of the causes and extent of blindness as well as demographic profiles of the individuals who are blind. Physicians and optometrists are mandated to report this information within ten days of diagnosis, and the information is then forwarded to various state divisions

and organizations for the blind. These reports are confidential and only used for determining program eligibility (General Assembly of the State of Indiana, 2003).

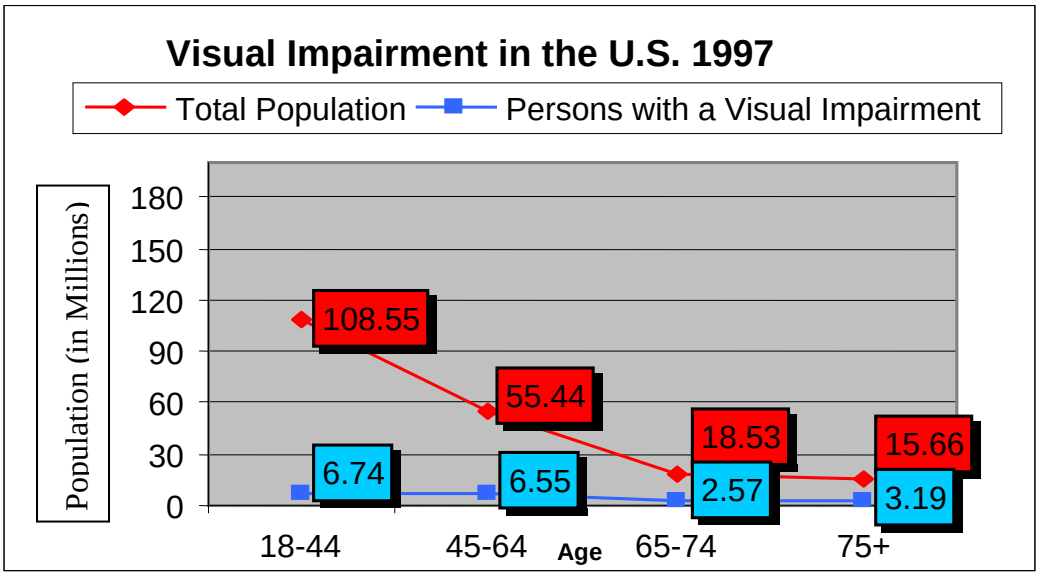
Information based on these reports has been studied to some degree. The Model Reporting Area for Blindness Statistical Study (1973) attempted to compile prevalence and incidence rates for blindness. Although there were issues regarding lack of standardization of the data and with under-reporting for some minorities, the results did illustrate the correlation between increased age and the occurrence of blindness (Tielsch, 2000). It is likely that should this type of reporting be implemented across the nation, standardized, and enforced, statistics regarding blindness and visual impairment would be much more reliable and accurate.

Despite the inter-survey variations, there are some noticeable commonalities between datasets concerning age and ethnicity. These refined statistical profiles may be helpful to a manufacturer of technologies, a service provider, researchers of various capacities, as well as people at high risk for these impairments.

Impact of Age on Visual Impairment

Chart 1 illustrates the correlation between age and visual impairment. A small percentage of people ages 18-44 have a vision impairment while 20% of people ages 75 and over have a visual impairment. The disproportionate distribution has implications for the supply of devices and services. People who fall within specific age ranges may prefer or require different types of assistive technology devices and different services than people in other age groups.

Chart 1- Visual Impairment in the U.S. 1997



(Adapted from: McNeil, 2001; and Adams, Hendershot and Marano, 1999)

Impact of Ethnicity on Visual Impairment

The data on frequency of visual impairment that results from a specific eye disease or disorder across ethnic groups varies greatly. The Baltimore Eye Survey collected data from over 5,000 African Americans and Caucasians over the age of 40 who lived in urban east Baltimore. The survey found significant differences in rates of visual impairment and blindness and its causes across ethnic groups. For example, while 27% of African Americans reported blindness related to age-related cataracts only 13% of Caucasians reported similar vision impairment.

Caucasians were most likely to be blind as a result of age-related macular degeneration, as it accounts for 30% of all cases of blindness in this group. In drastic contrast, none of the African Americans involved in this study were affected by macular degeneration. These variations demonstrate a need to ensure the availability of information for specific populations who are at high risk for the potential acquisition of each disorder. Medical professionals must be aware of these differences to properly monitor and diagnose their patients (Tielsch, 2000).

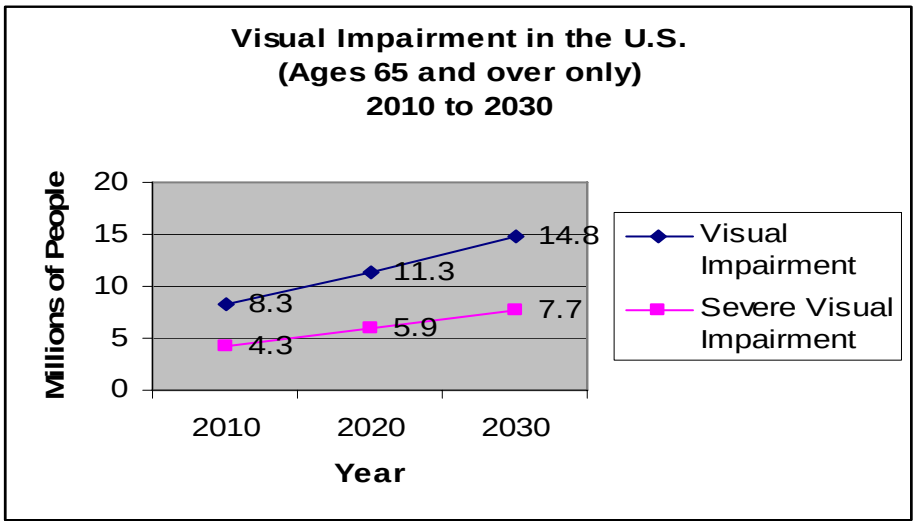
Economic Impact of Visual Impairment

According to the National Advisory Eye Council, the economic impact of visual disorders and disabilities was approximately $14.2 billion per year in 1981. By 1995 this figure was estimated to have risen to more than $38.4 billion per year. Of this number, eye diseases and disorders cost $22.3 billion in direct costs and $16.1 billion in indirect costs every year (National Alliance for Eye and Vision Research, 2002).

Growth of Visual Impairment and Blindness

According to the Lighthouse National Survey on Vision Loss, in 2010 there will be an estimated 8.3 million Americans, ages 65 and over who have some type of visual impairment. This number is expected to grow quickly from 2010 to 2030 to a total of 14.8 million elderly Americans with a visual impairment, 7.7 million of which will have a severe impairment (The Lighthouse Inc, 1995).

Chart 2- Visual Impairments in the U.S. 2010 to 2030



Estimates reported by the National Federation of the Blind state that a loss of vision affects 50,000 new people in the United States every year (National Alliance for Eye and Vision Research, 2002). Also, according to Lighthouse International, medical advancements leading to new treatments will most likely only restore partial vision in some individuals who are blind. Low vision products and services will still be required by these individuals; therefore the need for vision rehabilitation services is expected to stay at a relatively consistent level (Goodrich and Bailey, 2000).

Technologies

According to data from the 1994 National Health Interview Survey on Disability approximately 527,000 persons in the U.S. use some type of vision device. The following tables provide a breakdown of technology use by age of person and type of device.

Number and Percent of Persons who Use Vision Devices

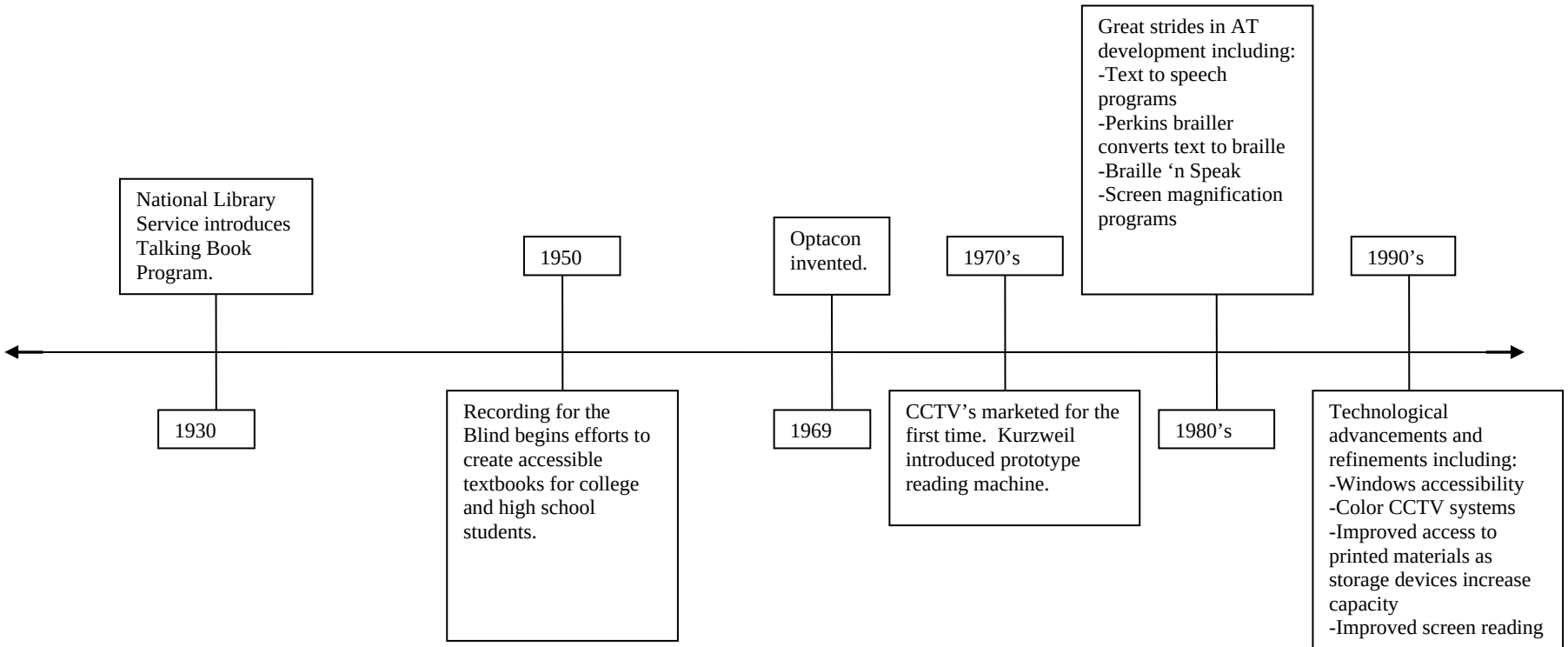
	AT device	All Ages	Ages 44 and under	Ages 45-64	Ages 65 and over
Total number of people	Any vision device*	527,000	123,000	135,000	268,000
Percentages of people using each device out of all those who use any vision device	Telescopic lenses	30%	32%	37%	26%
	Braille	11%	23%	17%	3%
	Readers	13%	12%	10%	15%
	White cane	25%	28%	36%	18%
	Computer equip	6%	16%	6%	3%
	Other	53%	42%	56%	56%

* Note: Categories are not mutually exclusive because people may use more than one device.

Adapted from Tables 1 and 3 in Trends and Differential Use of Assistive Technology Devices: United States, 1994. (Russell, Hendershot, LeClere, Howie, & Adler, 1997)

Technology for people with visual impairments has been in development since the 1930's. As outlined by Mary Beth Kullen in her article *Milestones in the Development of Technology for People Who are Blind or Visually Impaired,* assistive technology services and devices have been developed to assist individuals with a visual impairment overcome the barrier to information, even before the wide spread use of computers. Kullen (2003) presented the following history of AT for people with visual impairments.

Assistive Technology Developments for People with Visual Impairments: A Timeline



Adapted from: Kullen, M.B. (2003). Milestones in the development of technology for people who are blind and visually impaired. Retrieved February 19, 2004 from http://www.upshawinst.org/mileston.htm. Reprinted with permission

The timeline illustrates that innovation in assistive technology for the blind and visually impaired has been slow to develop. Many of the technologies that were invented over the course of the last century exist in similar forms as they have in the past. For example, braille displays continue to utilize piezoelectric or electromagnetic technology, both of which are expensive and highly fragile technologies. As a result, the cost of one braille cell can exceed seventy dollars. Problems with heat dissipation, weight, and bulk of current devices generate significant complaints within the community of people with visual impairments. These challenges have led to a decrease in the number of people with visual impairment who use braille as a literacy tool. In the United States today, only 110,000 people currently use braille (Doering, 2002).

Assistive technology has been referred to as a great equalizer for people with disabilities. Today, a wide range of technologies to assist individuals with a visual impairment have been developed in the areas of (1) activities of daily living, (2) computer access, (3) access to graphics and (4) wayfinding. Technology is currently being developed in the area of artificial vision. Recent and pending legislation is impacting availability and use of assistive technology for visually impaired persons in both educational and employment settings. Yet the lack of appropriate technology in these settings is a major barrier to the education and full employment of people with vision impairments (Lighthouse International, 2002).

This section will review technology that has been targeted specifically for the blindness/low vision market. Some technologies fall into the category of *universal design*; that is, they are useful to a broad range of users both with and without disabilities. Universal or transgenerational design has the capability of creating additional markets for technologies that are designed to benefit all people with functional limitations, including people with disabilities and the increasing population of aging Americans. This technology is generally lower cost as it has greater earning potential. In general, technology that incorporates accessibility for people with visual impairments will experience growing sales volumes due to the ever increasing number of the aging Americans.

People with visual impairments have a need for assistive technologies in a variety of areas. Technology is needed in the home to assist with activities of daily living; it is needed in the work and school environments to access written and graphical information presented on computers and on paper mediums; and it is needed in the community to successfully navigate in and around shared environments. The following information will provide an introductory review of assistive technologies that are available to benefit people with visual impairments.

Technology for Activities for Daily Living

Taking medication, identifying money, matching clothes, doing laundry, cooking, creating a grocery list, using a calculator, providing child care, reading the mail and telling time are just of few of the daily activities where a visual impairment can have an impact on independence. A variety of devices exist, many of which are “low tech” in nature, to enable individuals with a visual impairment to complete the tasks listed above independently. The effectiveness of these technologies can be enhanced when a potential user is provided with training on proper use and maintenance. This training is often provided by vision rehabilitation teachers, assistive technology specialists, or occupational therapists.

Optical devices (sometimes referred to as low vision aids) are lenses or magnifying devices that assist an individual to optimize remaining functional vision. These devices are generally well known and commonly used by people with visual impairments. According to the Lighthouse International (1995) 30 percent (or 366 of the 1219 of the adults surveyed) of adults with vision impairments (age 45 and older)who were surveyed report using an optical aid (such as a magnifier or telescope). Magnifiers help with near vision tasks such as reading the mail or recipes, dialing the phone, reading labels, or threading a needle. Telescopes enhance distance vision and can be used for a variety of distance and midrange visual activities such as seeing faces, watching TV, viewing the blackboard in school, reading environmental signage, and a variety of other daily activities. Optical devices are often prescribed or recommended by a low vision specialist. Examples include:

Hand-held magnifiers are small and portable, and can be placed over an object or text to enlarge or magnify. Magnifiers come in illuminated and non-illuminated versions.

Stand magnifiers are usually attached to a base and may have an adjustable arm. The magnifier can then be placed over the object to provide magnification while leaving the hands free. They are also available in illuminated and non-illuminated versions.

Hand-held or head-worn telescopes are aids that assist with distance vision. These technologies include binoculars, monoculars and spectacle-mounted telescopes. They are available with and without focus features. Higher technology versions that feature auto focus are also available. Telescopes can be used to observe and track objects at a distance. Binoculars are used for short-term distance observation for persons with vision in both eyes. Spectacle-mounted telescopes are used when hands are required to perform tasks.

Field expansion systems can aide people who have a visual field loss. These include the use of field awareness prisms and reverse telescopes. A prism can enhance a reduced peripheral filed by shifting images into view with small movements of the eye, thus enabling a person to detect objects located to each side of their body. Reverse telescopes “minify” the image to fit inside the patient's restricted field of vision (Windsor and Windsor, 2002). One disadvantage of using prisms or reverse telescopes is that the perception of the location of objects is distorted. As a result, training is necessary to ensure effective use (Corn and Koenig, 1996).

Microscopes use lenses that bring the object closer to the eye, allowing the image to fall on a larger area of the retina.

Digital Video magnifiers (also known as Closed Circuit Televisions (CCTV)) use a video camera to project a magnified image onto a video monitor, computer monitor or TV screen. They are used to enlarge printed materials, graphics, and small objects, enabling a person with low vision to both read and write independently. Documents, drawings, phone messages, etc. can be seen enlarged on the monitor. Features included in the digital video magnifier will vary with the specific model but may include the ability to: adjust the zoom up to 60 times the original size; alter the foreground and background colors; view the image in full color, black on white or reversing the color to white on black; and auto focus. Here are three subcategories of video magnifiers.

- **Portable electronic magnification systems** are battery powered portable and hand-scan video magnifiers. These smaller and lighter weight devices can be carried in a small travel case and may include an adaptor to facilitate handwriting. Some portable magnifiers can be connected to a television screen to provide a larger viewing area.

- **Video telescopes** use digital video image processing, microelectronics and advanced optics for distance viewing, and have been designed for use with a wide range of hand sizes and levels of dexterity. They have the high magnification, wide field of view and contrast enhancement capabilities of video reading stations (video magnifiers), but in a portable device.

- **Split-Screen capability** allows connection to a computer monitor where one half of the screen displays the magnified image from the video magnifier (example: hand-written correspondence) and the other half of the screen displays the computer image (example: word-processing program).

TASK LIGHTING

Adequate lighting is important for performing near distance tasks. The type of lighting and its intensity, color and direction can impact visual functioning. The amount of light that is optimal for each person with low vision may vary dramatically. As a result trial and error may be required to identify the optimal light source for any one individual. Many types and styles of task lighting are available with multiple options. These options include floor or tabletop models that may or may not feature swing or flexible arms. In some cases magnifying lenses of varying strengths are available on these arms. The following four categories of lighting are listed in descending order of usefulness to people with impaired sight (Center for the Partially Sighted, 2001).

Full spectrum lighting which closely mimics natural sunlight is optimal for people with the majority of vision impairments. Full spectrum bulbs are available on the market, but may be difficult to find. The greatest benefits of full spectrum bulbs are obtained when used in direct task lighting.

Incandescent lighting is found in many commonly used bulbs (such as table lamps). The light that it provides is a warm yellow light that is effective for near vision tasks such as reading.

Halogen lighting is growing in popularity because it is energy efficient and bulbs are changed less often. It provides a very pure light that allows the user to focus tightly on tasks (American Academy for an Energy-Efficient Economy, 2002). According to the Center for the Partially Sighted (2001) halogen lighting is capable of enhancing the contrast between print and background for some people with visual impairments. It does have a tendency to produce too much light and/or glare, making it an ineffective light choice for others.

Fluorescent lighting disperses a blue-white light evenly and without shadows over a wide area. It generates a lot of light and is highly energy efficient. This type of lighting is commonly found in public areas such as schools, shopping areas and offices. Fluorescent lighting generally produces a lot of glare.

Computer screens can prove difficult to use for many people with low vision. Some users may benefit from using limited room lighting when working on the computer as this enhances the contrast and effective brightness of the screen images.

Many people with visual impairments use large print, talking, and tactile devices and products to accommodate daily tasks. There are many products available that magnify or brighten, and products that can be touched, felt or heard. The goal for this type of assistive technology is to maximize its usability by

incorporating alternate or multiple channels for obtaining information. Here are six examples:

Modified time pieces are timepieces such as clocks, watches, and timers that come with enlarged print displays, braille or tactile displays, or auditory output. Alarm options are often included in these devices.

Modified calculators including large print, speech and braille output calculators, are available in both standard and scientific models. Many have high contrast, large print buttons with tactile indicators.

Adapted lab, medical and cooking equipment including a variety of measuring tools and other devices are available with alternate output formats such as auditory feedback, large print, or tactile information. These devices include construction tools, liquid level indicators, oscilloscopes, spectrometers, meters, scales, thermometers, blood pressure monitors, and glucometers. Many cooking devices that are not specifically designed for someone with a visual impairment can be extremely useful. For example, bread slicing guides, hamburger presses, egg dicers, microwave ovens, double spatulas, and single-cup hot water dispensers make some tasks that would generally require vision easier to perform by someone with a visual impairment.

Descriptive video service (DVS) provides voice narration that describes the actions and movements of the characters, as well as set the scene of television and movies. These services are also available for live performances. Other technologies that are available to enhance the access of multimedia for people with low vision include remote controls with large high contrast buttons, speech output, and/or voice recognition. Magnifying lenses can also be placed in front of the television screen to enlarge the image.

Telephone modifications include large print or tactile buttons or overlays, programmable number storage with voice recognition activation, large print and voice announce caller identification displays, and light probes to indicate which line is ringing.

Leisure activities can be made more accessible by items such as large print or braille playing cards, bingo cards, and board games. Braille Scrabble has a waffle-pattern overlay so tiles can be felt without dislodging them. Special chess and checker boards also help pieces remain in place. For more active team oriented games, basketballs, baseballs, and soccer balls are available with internal beeping mechanisms that allow people with visual impairments to track ball movements. Adaptive devices such as self-threading needles, needle threaders, and sewing machine guides assist with sewing activities.

Additional adapted leisure technologies are available; additional ideas are listed on the Texas School for the Blind and Visually Impaired website which can be accessed at http://www.tsbvi.edu/.

Labeling is used by people with visual impairments to identify items that are used often. Braille labels can be made using vinyl labeling tape, magnetic tape, plastic, paper, or any item that can be brailed using a slate and stylus, braille writer, or braille labeler. Examples of non-braille labels include large print, embossed letters, plastic letters, rubber bands, glue, bright-colored paint, nail polish, or any other method that would help identify an item visually or tactually. Labeling can be used on appliances, canned goods, clothing, thermostats, and other items. Here are two examples:

Card and bar code readers are portable electronic readers that allow the user to associate a recorded message with a bar code. Bar code readers' can use existing bar codes on products, or they can be created from self-adhesive, iron-on or banded labels. Messages can also be recorded on magnetic cards and then played back.

Clothing identifiers include a wide range of commercially available identification buttons or labels that can be sewn or pinned inside clothing. They enable someone to identify the color or style of clothing items and accessories. Some clothing identifiers feature auditory output.

Technologies for Reading and Writing

The majority of people produce a great deal of hand written information on a daily basis. People with visual disabilities must use assistive technology to produce written materials that they can easily access. Examples of those technologies include:

Braille slate and stylus provide a portable, low tech method for writing braille. The braille slate is a small hinged device that holds a piece of braille paper in between its front and back covers. Writing on a slate is done using a stylus, a small handle made of wood or plastic with a sharp metal point. The metal slate has a matrix of indented braille cells. By pressing the stylus into the paper while using the slate as a guide, braille dots are embossed on the paper. The dots are created on the underside of the paper, as a result the writing moves from right to left.

Angled writing stands are surfaces that raise the image or paper closer to the viewer making it easier to see for reading and writing, especially when using a magnifier.

Bold, felt-tipped pens are commonly available writing tools that are available in varying thickness and can be used to increase visibility of

printed items for people with visual impairments. The black felt-tipped pens can be used to highlight lines on maps, take notes and fill out forms.

Raised line and bold line paper provide tactile and visual cues that help define the work space for tracing, coloring and writing. Bold lined paper is available in both white and yellow with thick, black lines. A variety of line spacing options are available, including graph paper.

Writing and signature guides are used to assist with writing in a narrow space, on a straight line, or within specific margins. These guides come in various styles. Some conform to checks, envelopes, signatures, or standard letter format.

Mechanical braille writers have six keys (each representing an individual dot in a braille cell), a space bar, a carriage return, and a line feed key. Thick paper is inserted into the device and as keys are pressed, the braille dots are embossed on the paper.

Braille labelers are hand held devices, similar to tape labelers used by people without disabilities that emboss braille on 3/8" or 1/2" labeling tape. The upper rim of the dial is labeled with braille; the lower rim has the standard print alphabet making these devices accessible to people with and without visual impairments. Commonly used symbols include short words, contractions, and punctuations marks.

Digital recorders/organizers are electronic voice-based organizers with note-taking, phone number, address and diary features. Because they are digital, they can be used to add, insert, delete and edit separate messages. They can also be used for quick searching when equipped with auditory feedback.

Talking electronic dictionaries contain a dictionary, thesaurus, grammar and spelling checker. They are available with both large print and auditory output.

Electronic note takers are portable devices with word processing capabilities. They have either a braille or QWERTY keyboard for input and use refreshable braille or auditory output. Most allow the user to take notes, record appointments, and record and access address information. Some electronic note takers provide e-mail and Internet access.

Reading is an activity that is enjoyed during leisure time and mandatory for work and school activities. Assistive technology that allows people with visual impairment to access printed materials is a necessary component in providing equal access across environments. It is important to note that while braille a recognized method of text access for people with visual impairments, only 10%

of American children who are blind are taught the technique (Jaquiss, 2003). Examples of technology for reading include:

Large print books and documents allow people who have low vision to access written materials by simply increasing the font size of the print. The necessary font size will differ depending upon the user and the level of visual impairment.

Braille materials allow people who are visually impaired to access text that has been converted into braille representations. This tactile representation of letters generally requires a great deal more space to print than conventional writing and is expensive to produce.

Audio materials allow people who are visually impaired to use auditory skills as opposed to visual skills. Because auditory skills do not take a great deal of training to use, it is very common method of alternative access to printed materials.

Typoscopes are reading aids consisting of a single rectangular hole cut in a dark card or plastic sheet. When placed over print only one or two lines can be viewed at a time. Some people with visual impairments find that typoscopes reduce clutter and confusion which allows them to read more easily or quickly.

Money identifiers are small electronic devices that provide speech output identification of paper money. The money can be inserted and read in any orientation. They turn on and off quickly and automatically. The volume is adjustable and a standard headphone jack provides privacy.

Tape recorders and players are available with variable speed and 4-track play and record features. These tape players work with analog taped books produced by the Library of Congress and Recording for the Blind & Dyslexic.

Digitally rendered books are a multimedia production of a print book. The Digital Accessible Information System (DAISY) is a standard for creating digital books. The audio uses human voice narration, just as with an analog audiocassette, but this format provides easy to use navigation features that allow readers to skip to specific pages, chapters, sections, and paragraphs. They can also place electronic bookmarks or use an index to navigate. DAISY books can be read on a DAISY digital talking book player or on a computer having appropriate reader software.

Computer Access Technologies

Adapting the computer for use by individuals with a visual impairment is primarily accomplished by using large print, electronic speech and/or braille output alternatives. The following is a list of technologies that adapt or modify the computer:

External screen magnifiers can be hung or clamped on the outside of the computer monitor or placed on a stand in front of the screen. They are able to magnify the image on the computer monitor by 1.5 to 2.5 times.

Large computer monitors with diagonal dimensions of 19", 20" or 21" are effective in increasing the size of the information that appears on a computer screen when used in conjunction with lowering the video display resolution. These accommodations will provide magnification of up to two times the standard, making it a useful accommodation for those with limited magnification needs. It is important to note that when a large screen size is used in conjunction with magnification software, the user is able to view a larger portion of the screen at one time.

Keyboard labels are large print labels that are affixed to the computer keys in order to make keyboard elements more visible. These labels are available in upper and lower case with various color schemes including black on white, white on black, and black on yellow.

Glare filters are available for individuals who experience light-sensitivity. Full spectrum light filters (blocks UV rays), glare guards, anti-radiation and anti-glare filters, and reflective coating may be useful.

Color and contrast selection systems or applications allow the individual user to choose the color combination, level of screen brightness, and contrast displayed.

Font style and size can be selected within most common operating systems (Windows, Mac, Linux, Unix). These selections allow the user to enhance their ability to view the information as it appears on the screen.

Screen magnification programs (also referred to as screen enlargement utilities or large print programs) allow users to enlarge a portion of the screen. They turn the computer monitor into a view port showing only a portion of an enlarged display. Users then employ a mouse or keyboard commands to move this view port to different areas of the display. Magnification programs also attempt to track where users are working, following the input focus and the activation of windows, menus, and secondary windows by automatically moving the view port to the active area.

Specialized features of some magnification programs include:

- character size up to 16X;
- speech output;
- cursor and mouse pointer enhancements;
- reverse display (white on black) on demand; and
- hands-free scrolling of text in multiple directions.

Auditory output from the computer is provided by two components: screen reading software and a speech synthesizer. Screen reading software sends the information from the computer to a speech synthesizer to produce auditory output. The synthesizer can be hardware or software-based. Software based applications use the computer's internal sound card. The screen reader software monitors the changes on the computer screen and sends the information to the synthesizer to be spoken. When using these programs, the user must navigate the operating system and application software programs by using keyboard commands instead of pointing and clicking with the mouse.

Most speech output systems allow the user to:

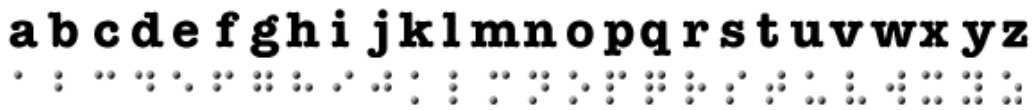
- change the volume, pitch, and speed of the voice, as well as to silence the speech output;
- set the keyboard echo feature when typing to speak letters, words or both;
- read and re-read information on the screen by character, word, line, screen, entire document, and sometimes by sentence and paragraph;
- hear the current screen focus such as a drop down menu or dialog box;
- control the amount of punctuation spoken;
- add modified "words" to a phonetic dictionary to correct mispronunciations;
- announce the status of the keyboard controls (number lock, caps locked, etc.); and
- connect a refreshable braille device.

Some individuals who are visually impaired learn to read and write in braille, a tactile code of raised dots embossed on paper. The braille alphabet is based on a six-dot cell that is arranged in two columns of three dots each. In the simplest form of braille (called Grade 1 or uncontracted braille), each cell stands for one printed letter of the alphabet. The dot placement corresponds to the following table.

Dot Arrangement in 6-Dot Braille

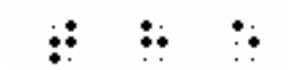
1	**4**
2	**5**
3	**6**

Braille Alphabet



All words are spelled out letter by letter. For example, “the” is written as three specific cells or characters in Grade 1 braille:

The Word “the” in Uncontracted Braille

the 

In Grade 2 or contracted braille, common letter groups that occur frequently in word spellings are represented by a contraction. Hence, "the" is represented by one cell or character:

The Word “the” in Contracted Braille

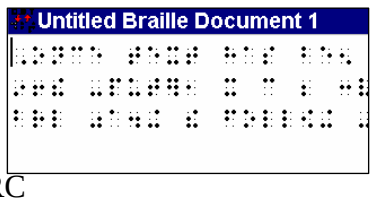
the 

Contracted braille is used most often as it helps to increase the speed of reading and writing and reduces the number of characters required to represent the same material in uncontracted braille. It also reduces the size of braille books, which can be quite large. The use of contractions is governed by very specific rules that facilitate the representation and deciphering of exact word meanings and spellings, word context and associated phonics. There are 63 braille symbols and many contractions have more than one meaning depending upon the placement in a word or sentence. For example, the symbol created with dots 2, 5, and 6 can represent “dis,” “dd,” a period, or a dollar sign, depending on the context in which they are used. There are at least four different braille codes currently used in the U.S., including Literary Braille Code, Nemeth Code used for math and science, Computer Braille Code and Music Braille Code. The use of a particular code is dependent upon the type of material being transcribed.

Use of the computer makes the production of braille faster and less expensive. Text that has been entered or scanned into the computer can be converted into hard copy braille by connecting a braille embosser and using braille translation software. In addition, graphics can be presented in tactile form using raised lines and bumps, which can be produced by braille embossers.

> **Braille translation software** converts text that has been typed into or stored on the computer into braille code format. Some programs actually produce a simulated braille font on the screen so you can see what the final product will look like when it is printed using a braille embosser. In general, one text page will be converted into three braille pages.

Representation of a Braille Document



Braille embossers are like printers in that they create the raised braille dots on braille paper. Embossers are also used in the production of tactile graphics, by producing raised dots to outline the shapes. Embossers range in price, size, speed and type. Speed is indicated by the number of characters printed per second, abbreviated "cps." The price of the embosser is usually related to the speed of output.

Types of embossers include:

- personal embossers – designed for personal use;
- high volume embossers – designed for commercial production;
- interpoint embossers – emboss on both sides of the Braille paper; and
- graphic embossers – used for the production of tactile graphics.

Refreshable braille displays are devices that use a series of moveable pins that raise and lower to represent text stored electronically in braille format. Text is represented in contracted or uncontracted braille and displayed in a row of 18, 20, 32, 40, 65 or 80 cells. Pressing a bar or button on the device changes or “refreshes” the display to show the next or previous section of text. Refreshable braille displays may be interfaced to the computer and used to display text information on the computer’s screen in Braille format. Braille displays are also incorporated in other technologies such as portable note taking devices and calculators.

Scanning Systems consist of a scanner (hardware) and an optical character recognition program (software). The scanner imports the image of a printed page into memory. The optical character recognition (OCR) software converts the image of the printed page into text that can then be stored in a file and manipulated. Scanning systems can be stand-alone devices with a built-in screen reader or they can be components of a computer system. When used together with various assistive technologies, scanning systems turn the computer into a reading machine. Screen reading software converts the text into synthesized speech. Magnification software can be used to enlarge the images on the computer screen.

Internet accessibility has become a growing issue as the Internet has become one of the largest sources of information for individuals all over the globe. There are many organizational efforts underway to enable people with disabilities to access the Internet. Yet to many visually impaired people, the Internet still remains inaccessible due to its visual nature (graphics, video, hyperlinks, etc.). Section 508 of the Rehabilitation Act mandates that all electronic and information technology purchased by the government is accessible for people with disabilities. This law covers a broad range of items including “multi-media

productions, information systems to telecommunications, kiosks to hardware, computers to copiers and fax machines (Government Services Administration, 2004)."

Markup languages specify the representation and formatting of electronic information. Specifically, markup refers to the sequence of characters or other symbols that you insert into a text or word processing file to indicate how the file should look when it is printed or displayed or to describe the document's logical structure (TechTarget Network, 2003). Markup languages provide an easy method of representing material in multiple types of output methods. For example, information can be represented in many useful ways if a parser is available to convert the information to a language the computer will understand and a browser is available to display that information. Various markup language formats exist, including standard generalized markup language (SGML), extensible markup language (XML), hypertext markup language (HTML), and the digital accessible information system (DAISY).

Standard markup languages allow users to easily navigate through text and to separate structural elements from presentational elements. Markup languages tend to be non-proprietary oriented or open source in format, although they may have difficulties with some open-source tools, such as decoders and browsers. There are currently differences in standards for the various markup languages and there is no single browser that will allow you to have access to all of the markup languages at this time. Efforts to improve web accessibility have been undertaken by the World Wide Web Consortium (W3C). The W3C's Web Accessibility Initiative has published many documents and provided the single most comprehensive and useful set of resources for web designers who wish to make their sites more accessible to people with disabilities (World Wide Web Consortium, 2000).

ACCESS TO GRAPHICS

For some individuals with usable vision, access to graphics can often be obtained by changing the size, altering colors to provide higher contrast, or by using simple assistive technology. However, individuals who are blind require that the information contained within graphics or the graphics themselves be made available in alternate formats. These formats include tactile representation, auditory representation, and haptic interfaces.

Access to Graphics for People with Low Vision

Digital Video Magnifiers or Closed Circuit Televisions (CCTV) allow people who have some residual vision to access printed graphics by presenting an enlarged image. The digital video magnifier is capable of enlarging the print and offering contrast enhancement to items placed under the camera on either a

dedicated screen (desktop model) or an attached screen (portable models). They are also commonly referred to as closed circuit televisions (CCTV) as early models used standard television screens to display the enlarged images. These devices generally provide magnification from 10 to 100 times depending on the model used (Abledata, 2004). A full discussion of this technology is available from Abledata in a Fact Sheet on Video Magnifiers (see references).

Screen magnification software (i.e. ZoomText) can be used to enhance images presented on the computer, much in the same way it is used for computer generated text. Users may encounter problems as the magnification software enlarges the images in such a way the entire item cannot be displayed on the screen.

Tactile Drawing Tools and Kits

Access to graphics can be provided by converting them into tactile drawings. Methods include thermoform, swell or capsule paper, and braille embossing. Conversion methods for graphics are defined as follows:

- **Thermoform** is a vacuum forming machine that uses heat to produce braille and graphic images on Braillon plastic sheets from a master document. Master documents, made of flat model representations or the graphic, must be made correctly in order to ensure that the image can be transferred effectively to the reproduction on the plastic sheet. While this method offers good height and texture variations, it is extremely labor intensive and time consuming (National Centre for Tactile Documents, (NCTD), 2004).

- **Swell or Capsule Paper Graphics** are created using a specialized paper that has heat reactive components embedded in the paper. When the line drawings are exposed to heat (via a heat pen, laser jet printer, photocopier, or other heat processor) the images swells to create tactile images (American Thermoform Corporation, 2003). While this method of creating tactile graphics is easy to use and edit, it creates limited height variation on the paper (NCTD, 2004).

- **Embossed Graphics** are created using braille dots to form images that can be printed using a braille embosser (i.e. Tiger Printer). In most cases, images can be created via specialized software programs such as Duxbury or Megadots. However, the Tiger Embossers are able to use standard windows products to create embossed documents with greater density than its competitors (ViewPlus Technologies, 2003a). Embossed graphics have the advantage of easy and inexpensive reproduction. However, the majority of embossers do not provide a great deal of height variation to illustrate the complexities of the graphic (NCTD, 2004).

Auditory Descriptions of Graphics

In some cases auditory descriptions of graphics can be more beneficial to people with visual impairments. For example, when a person with a visual impairment has not been trained to interpret tactile graphics, they may receive a great deal more information from an auditory description of the items contained in the graphic. These descriptions generally supply a detailed verbal description of the image that is presented verbally. The following example is a text description used to describe a map entitled *War in the Middle States 1776 to 1777* from a standard history text book:

> There is a map on this page that shows the states of Maine, New Hampshire, Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Delaware, Pennsylvania, Maryland, Virginia and northeastern Canada. The title of the map is War in the Middle States 1776 to 1777. The map key shows a blue line for American forces, a red line for British forces, a blue star for American victories and a red star for British victories. The map scale of miles shows one half inch equals 100 miles. The American forces and victories are as follows: Washington travels south from Boston to New York City and then south to New Jersey with victories in Princeton and Trenton, New Jersey. He then travels north to Morristown, Pennsylvania. A British force, led by Howe, begins with a British victory in Long Island. He then travels south in the Atlantic Ocean to Chesapeake Bay and then travels north up the bay, and lands in Delaware for a victory at Brandywine. He then travels a little farther north for a victory in Germantown

In this case, the verbal description was recorded onto an audio tape. In other cases, graphics on websites must be described in order to provide full access the information contained on a site. A review of the types of auditory descriptions that may be available on a web site include:

- **Alternative Text Tags or alt tags** are described by the W3C (1998) as a textual alternative that represents the function of a graphic. For example the graphic of a check mark with ABC positioned above it contains the alt tag of “spelling and grammar”.

- **Long descriptions often referred to as “longdesc”** provide a full description of a graphic that supplements the short description provided by an alt tag (Microsoft Corporation, 2004).

- **Description links or D-links** provide a link to a more detailed description of the item contained in the graphic. The information may be located on the bottom of the existing page or on a separate page (W3C, 1998).

Scalable vector graphics can also be used to display two dimensional images on the web in XML formats (Eisenberg, 2001). SVG allow for the compact representation of images to be communicated over the internet and constructed on the target computer. This format allows for easy manipulation of images on a screen without distorting the image.

Talking Tactile Maps (i.e. Nomad Mentor & Talking Tactile Tablet)

This system is made up of a touch screen and a tactile diagram created in one of the forms mentioned above. The device is able to enhance the information provided on the tactile graphic through the use of auditory output. In the case of the Nomad Mentor, the information is programmed using a computer and then stored on the digitized pad that has a built in speech synthesizer. When a user presses points on the tactile image, the finger pressure is transmitted through the touch screen. By comparing the position of each press against a database of predefined hotspots, the computer is able to provide identifying auditory feedback to the user (Quantum Technology, 2004). The Talking Tactile Tablet also links auditory output to programmed positions on the touch pad; however it is a computer peripheral device (Landau, 2004). As a result, the information can be changed easily as different graphics are positioned on the touch pad.

Audio-Accessible Graphing Calculator

The Accessible Graphing Calculator is a scientific calculator software program that provides auditory feedback for visually impaired users. Unlike a hand-held calculator, it displays results through speech and sounds as well as visually presenting numbers and graphs. The sound guides the user along the graph lines with pitch. It provides direct access to graphic output using audio sound or by printing the resulting graphic on a Tiger embosser. The Accessible Graphing Calculator is now in commercial distribution (ViewPlus Technologies, 2003b).

WinTriangle Scientific Word Processor

This specialized word processor currently in development is capable of displaying and voicing conventional text and the symbols commonly used in math and scientific expressions. Output is available through auditory, tactile, and visual (on a DOS screen) outputs or any combination of those output options. Triangle can also serve as a graphing calculator; a viewer for x-y plots; a table viewer; or a touch-tell program (Science Access Project, 1999).

Tactile Access to Graphics

Haptic Access

Haptic Interfaces employ the sense of touch to display the information contained within graphics on the internet. If the graphic information on the screen is displayed using digital information, the haptic graphical user interface can

present it using tactile feedback (Sjöström, n.d.). The Phantom™ (Personal Haptic Interface Mechanism) is a haptic device that provides “high-fidelity three dimensional force feedback (SensAble Technologies, 2004).” The computer interface system has pivoting thimble-like receptacles mounted at the ends of computerized arms, into which a person can insert their fingers and then virtually "feel" the shape, texture and weight of objects on the computer screen---as well as virtually "manipulate" and otherwise interact with those objects. Haptic interfaces have many applications in the video gaming industry as well. Products such as the Flight Force ™ and WingMan® are force feedback devices produced by Logitech for the gaming industry. Commercial applications for Haptic interfaces may drive the development of these devices.

Tactile PC Display is also slowly becoming a reality. Companies such as Uniplan, LTD. and KGS, Corp. both located in Japan are creating refreshable graphics devices. The Uniplan device will cost approximately $2,480 when it is released on a worldwide basis in the early part of 2005 (Japan Times, 2003). KGS products will display characters in braille or in written word form, and will also display graphics. Downfalls of these devices include their relative bulkiness and weight, which ranges from three to five pounds. The KGS display is based on piezoelectric refreshable braille display technology and sells for approximately $13,500. Orbital Research has developed and patented a low power, low cost micro-electrical-mechanical (MEMS) micro-valve technology that can be applied to refreshable braille display applications. This technology uses electrostatic force to operate pneumatic cells that can serve to raise and lower pins in the braille display. While this technology holds promise, it has yet to come to market (Orbital Research, 2004). Additional refreshable graphic displays are currently in development.

WAYFINDING TECHNOLOGIES

Navigation aids for the blind include technologies that help with orientation, mobility, and spatial perception. Technologies that exist for navigational purposes, or obstacle detection and avoidance include:

The Global Positioning System (GPS) and Geographic Information Systems (GPS/GIS) are distinct but complimentary technologies that are increasing in popularity as wayfinding tools for people with visual impairments. The GPS operates using a web of 24 satellites placed and maintained by the U.S. Department of Defense around the earths’ orbit. These satellites transmit information to ground based (including body worn or hand held) receivers. These receivers utilize the satellite data to triangulate their geographic location. GPS satellite signals can be blocked by geographic and structural barriers. For this reason, GPS receivers cannot be used indoors. Typically, GPS has a positional resolution of about 10 meters (TechTarget Network, 2003). GIS is a collection of location specific information stored in a database and spatially referenced (United States Census Bureau, 2001a). There are many GIS databases available, however

most GIS databases were intended to supplement visual information available to sighted users. GIS databases are commonly developed for roadway and urban area navigation rather than the pedestrian mobility. GIS databases must be periodically updated (new buildings, streets and addresses). Combined GPS/GIS systems identify the user's geographic location and provide information about this location (street, building name, address, city) for route planning and informational purposes (Wyoming Geographic Information Science Center, 2002). GPS/GIS systems often allow the user to enter navigation notes and provide wayfinding cues. Examples of GPS/GIS systems that are currently being used in assistive devices are the Victor Trekker by VisuAide, GPS Braille Note by Pulse Data Humanware and Strider and Atlas Speaks (talking map) by Arkenstone.

Talking Signs® orients people with visual impairments during wayfinding activities by providing directional auditory messages (Crandall, Bentzen, Myers, and Brabyn, 2001).Talking Signs operates using infrared receivers to decode infrared signals from transmitters located about the environment (e.g. street, library). Each receiver has a distinct audio message that provides the user with navigational information. The user sweeps the receiver until its signal strength is maximized (pointing at a nearby transmitter). Talking Signs is heralded as the first infrared system to work both indoors and outdoors. Talking Signs® transmitters in wireless (WiFi) networks are available in the most recent product embodiment (Talking Signs, 2001).

Long or white canes are the most popular navigational aid for people who are blind. They are relatively easy to use, lightweight, and inexpensive. The entire cane is designed to maximize kinesthetic and auditory exploration of the environment. The shaft and tip work together to sense and then relay the tactile information to the grip. It is the simplest device to detect both obstacles and landmarks.

Laser canes produce three beams of laser light to identify objects in a path of travel. Reflected rays are detected to identify objects in the user's path. The Laser Cane generates two audio tones and a vibration for high, low and mid-height objects. Sweeping the cane provides 3-dimensional information about the user's surroundings (Nurion-Raycal, 2000).

The **Sonic guide** is an electronic travel aid that uses a down-swept FM ultrasound signal to detect obstacles. A two-channel receiver picks up and converts the signal into a binaural audio signal (Eye of the Pacific Guide Dogs and Mobility Services, 2003).

The bilingual talking compass is a hand held device that verbally announces eight major compass points including north, east, south, west, northeast, northwest, southeast and southwest. It announces the direction that the compass is pointing at the touch of a button and provides output

using digitized speech in two languages, which can be selected from a large list of major languages (Robotron, 2000).

The Mowat Sensor is a lightweight, hand-held ultrasonic torch. It detects objects by sending out brief pulses of high frequency sound (ultrasound). Users can tell how close they are to an object by the rate of vibration produced by the Mowat Sensor. The device ignores everything but the closest object within the beam (Guide Dogs NSW/ACT, 2003).

The Miniguide (miniaturized Mowat Sensor) is a mobility aid designed to provide information to a blind traveler which will supplement that provided by other aids such as the white cane and dog guide. There is both an audio and a tactile version in which sensors send and receive data (GDP Research, n.d.).

Accessible or audible pedestrian signals provide precise auditory cues (i.e. chirps, tones, verbal messages, and/or vibrotactile information) to notify pedestrians with visual impairments of “walk Intervals” at intersections. The system is designed to supplement vehicular sounds that are conventionally used as auditory cues to indicate the on-set of a walk interval at an intersection. Accessible or audible pedestrian signals is particularly useful at unfamiliar intersections and at intersections where curb-rams may create ambiguity around the persons arrival at an intersection (Bentzen, 1998).

Assessment of Needs

Assistive technology can mean a difference between gainful employment and unemployment; between success in the educational system and failure; and between integration into the community and segregation. The National Council on Disability (2000) elegantly stated the importance of AT its report on the Federal Policy Barriers to Assistive Technology, “In an ideal climate, no person with a disability should be denied the opportunity to obtain assistive technology and transfer its inherent potential into viable, life-fulfilling endeavor.” In order to ensure that all people can benefit from assistive technology, a comprehensive assessment must be performed.

The evaluation of assistive technology is listed as one of the mandated assistive technology services in the Technology Related Assistance for Individuals with Disabilities Act of 1988 (Tech Act) (PL 100-407). The law states that “the evaluation of the needs of an individual with a disability, including a functional evaluation of the individual in the individual’s customary environment” is a necessary portion of AT services. A comprehensive evaluation must be conducted before any device is recommended for a person who is blind or visually impaired. This assessment should consider the individuals current functional level, the prognosis for future visual functioning, a realistic look at the activities to be conducted, and the environment in which these activities will take place. In some cases, the interests of parties who will also have to interact with the technology, such as a school system or employer will be vital to the success of the technology in the given environment. Any assessment that disregards a portion of the assessment tasks described above will likely result in frustration for the user and needless cost. If, at any time, the person with a disability is not included in the decision making processes outlined above the likelihood of failure of the technology is greatly increased. Also, it is important to remember that multiple devices may be needed to ensure that the majority of the activities the person will be required to complete in a day can be done as independently as possible.

Cook and Hussey (2002) describe a six step process that encompasses the basic steps necessary to complete an effective assistive technology assessment. The **referral and intake stage** marks the initial introduction to the person with a disability (customer) during which time the service provider will determine what AT needs exist and if he/she is capable of meeting the needs of the customer. Also, during this stage funding sources for technology interventions are also identified. During the **initial evaluation stage** the evaluator, along with the person with a visual impairment, will take a closer look at the specific AT needs of the customer and the skills that they will bring to each task. This process, often called the needs identification process, allows an initial match to be made between the customer, his or her tasks, the environment in which these tasks will be performed, and the skills and abilities of the customer. After this evaluation is completed, the **recommendation stage** begins with the report of the team’s

findings and suggestions for AT devices and services. These recommendations are then applied in the **implementation stage** with the completion of tasks related to acquisition, application, and training. The final two stages, **follow-up and follow along**, are tasks that will likely continue for some time after the initial application of the assistive technology. Both require that issues related to maintenance, repair, and evaluation of the success of the AT application be monitored.

Many other assessment models have been discussed in the assistive technology literature. For example, the Human Activity Assistive Technology (HAAT) Model described by Cook and Hussey (2002) as an adaptation of Bailey's (1989) Model of Human Performance, includes an examination of the human, the activities to be completed, and the assistive technology intervention within the context of the environment. The Matching Person and Technology (MPT) Model described by Scherer (2004) offers a framework to consider the best possible match between the customer, the technology intervention, and the context of use. Full discussion of these and some additional models can be found in articles by Lenker and Paquet (2003) and Bromley (2001).

There are a variety of resources and centers that provide assistive technology evaluation and training services. Referral for these services can be obtained by contacting state and provincial agencies, listed in Appendix A. The Rehabilitation Engineering and Assistive Technology Society of North America (RESNA) (2004) website offers a search feature to locate Assistive Technology Practitioners in any given area. In many cases, services can also be obtained from Independent Living Centers.

Despite the existence of the state and federal agencies that are available to assist people to obtain assistive technology, many people do not receive assistive technology or the services associated with its provision. According to the NCD (2000), many of the issues stem from a lack of knowledge about existing assistive technology, how to pay for it, and where to get it. The large numbers of older Americans are at a particular disadvantage when seeking to obtain AT as they do not have access to resources in the school systems or vocational rehabilitation programs. Therefore advocacy agencies such as the American Foundation for the Blind (AFB), the National Foundation of the Blind (NFB), and the American Association of Retired Persons (AARP) must provide as much information as possible about the low vision services and assistive technologies available to older Americans. In order to ensure that this age group receives this valuable information, the National Eye Institute in conjunction with the National Eye Health Education Program (NEHEP) is conducting a Low Vision Public Education Program. This program "aims to increase awareness of low vision and its impact on quality of life and is directed toward people with low vision, their families and friends, and the health care and service professionals who care for them (National Eye Institute, 1999)."

Legislation

Recent legislation has focused on improving the access of people with disabilities to education, employment, services, and information. Ensuring that students with disabilities are able to get high quality education is vital to ensure their prosperity in American society. To promote this access, Congress passed the **Individuals with Disabilities Education Act Amendments of 1997 (IDEA)** through which children with disabilities are guaranteed the services necessary for them to receive a free and appropriate public education (FAPE) that meets their education and related services needs (Rehabilitation Engineering and Assistive Technology Association of North America (RESNA), 2003). As a means to that end, IDEA '97 states that the IEP team shall "consider whether the child requires assistive technology devices and services". It further states:

> "In the case of a child who is blind or visually impaired, the IEP team shall provide for instruction in braille and the use of braille unless the IEP team determines, after an evaluation of the child's reading and writing skills, needs, and appropriate reading and writing media (including an evaluation of the child's future needs for instruction in braille or the use of braille), that instruction in braille or the use of braille is not appropriate for the child (PL 105-17, 1997)"

These mandates are essential to ensuring equal access to education for students with visual impairments. However, a recent report by the National Council of Disability (2000a) entitled Back to School on Civil Rights, stated the enforcement of IDEA over the years has been "inconsistent, ineffective, and lacking any real teeth". A bill entitled Improving Educational Results for Children with Disabilities (HR 1350) is currently making its way through congress (House Education and Workforce Committee, 2003a). In the Bill Summary, the House Education and Workforce Committee (2003b) promises that this new bill will ease compliance issues and ensure that all children are learning. This bill incorporates components of both IDEA and the proposed Instructional Materials Accessibility Act of 2002 [Note: The IMAA of 2002 mandates access to textbooks and other print materials for students who are blind, visually impaired or otherwise print disabled by creating a system for the acquisition and distribution of such materials (American Federation for the Blind, 2002)]. In the current draft of this bill, the AT provisions outlined in this law will remain as amended in 1997 (Smith and McGinley, 2003). The IMAA provisions are included in both the House of Representatives and Senate versions of this proposed law (National Association of State Directors of Special Education (NASDSE), 2003).

The unemployment rates of people with visual impairments are staggering. Fewer than half of visually impaired adults of working age were employed. For individuals of working age who meet the requirements of legally blind, only 32% were employed (National Center for Health Statistics, 1998). The landmark civil

rights legislation of 1990, the **American's with Disabilities Act (ADA)** is designed to provide equal access to employment to all people with disabilities. The law prohibits discrimination on the basis of disability and mandates reasonable accommodation by employers for people with disabilities. For many people with blindness and visual impairment this means that they will be provided with the accommodations necessary to complete essential job functions if they choose to disclose their disability. Reasonable accommodation calls for an employer to adapt, upon employee disclosure of disability, a position or tasks associated with a position that would allow a person with a disability to experience equal employment opportunities. Reasonable accommodations generally fall into one of three categories: accommodation to the job application process, accommodation to allow the person with a disability to perform the essential functions of a job; and accommodation to facilities to ensure equal access to all areas of the work environment (Office of Personnel Management, 2001). It is important to note that the ADA does not require the employer to alter the essential functions of the position, nor does it mandate accommodations that would present an undue hardship to the employer. If employees with hidden disabilities choose not to disclose the disability to the employee, they are not covered by the ADA until said disclosure is made.

The **Rehabilitation Act of 1973 and its amendments** remind us that disability is a natural part of the human experience that it in no way diminishes the rights of people to live independently, make their own choices, pursue meaningful careers, and experience full participation in society (Legal Information Institute, 2003). The Rehabilitation Act Amendments are sweeping in terms of access to services in both independent living and vocational rehabilitation in that they established and funded both the initial Centers for Independent Living and Vocational Rehabilitation services. The 1998 Amendments continue to strengthen the rights of consumer control and informed choice (Wehmeyer, 2003).

Vocation rehabilitation services for people who are blind and visually impaired began with the opening of the Perkins school, which was first known as the New England Asylum for the Blind, in 1832 (Rubin and Roessler, 1987). Since that time services to people with disabilities has been mandated by the Rehabilitation Act and its amendments. Vocational rehabilitation services are a joint federal and state system designed to assist people with all disabilities to obtain gainful employment. While all other disabilities groups receive services through a central outlet, people with visual impairments have a separate rehabilitation facility. The National Federation for the Blind supports continued separation of rehabilitative services for people who are blind based on the fact that these agencies are more equipped to support the needs of people who are blind and visually impaired (National Federation for the Blind, 2003).

Access to information has long been a barrier to people with visual impairment and blindness. As a result, Congress amended the Rehabilitation Act in 1998 to

include **Section 508** which requires that federal agencies provide equal access to information to all people with disabilities whether they are employees of the federal government or members of the public at large (Government Services Agency, 2002). While applicable to all electronic and information technology used by the federal government, the scope of this legislation does not apply to entities outside of the federal sector; however, many private and research entities are working to improve access to digital information (Access Board, 2000). In addition, the federal government is promoting the advantage of the agencies it works with to make their electronic and information technology accessible. For example, vendors of these technologies are highly motivated to sell to the federal government, ensuring accessibility of their products puts them at a distinct competitive advantage (Government Services Association, 2002). According to the Information Technology Technical Assistance and Training Center (ITTATC) (2004), many states are also passing education and information technology accessibility laws.

Additional legislation, entitled the **Medicare Vision Rehabilitation Services Act** (S.1967/H.R.2484), has been introduced to both the House of Representatives and the US Senate that would improve upon the sporadic coverage currently offered by Medicare. This legislation would provide uniform national coverage for older Americans who require vision rehabilitation services. In addition, the bill would establish qualifications under Medicare for specialized vision rehabilitation professionals and describes how their services could be covered for the first time (Medicare Now, 2003).

Funding Sources

Technology for Visual Impairments – Funding Sources

Funding Source	Legislative/Legal Basis	Eligibility	Policies
Alternative Loan Programs	Title III of the Assistive Technology Act of 1998 (P.L. 105-394).	Based upon the applicants credit history and likelihood that the loan will be repaid	State programs vary. For additional information on programs in your state see http://www.resna.org/AFTAP/state/index.html.
Veterans Administration	Title 38 of the U.S. Code	Veteran's service/financial status based on Categories A-C	Equipment is paid for when deemed part of the overall medical or rehabilitation intervention, which is dependent upon eligibility status.
State Vocational Rehabilitation Agencies	Rehabilitation Act Amendments (P.L. 99-506)	Person with a disability who requires technology to obtain and/or maintain employment	State VR agencies are considered a funding source of last resort – if no other funding for AT can be obtained and it is required to perform gainful employment VR may pay for technology. Individual decisions will be made with VR counselor
Social Security Work Expenses	Originally created as Social Security Act of 1936 (P.L. 74-271). Amended through several acts through 2003. Please see http://www.ssa.gov/OP_Home/comp2/comp2toc.html for additional amendments.	Employed recipient of SSI or SSDI who has vision of 20/200 or less and a visual field of 20 degrees or less.	Supplemental Security Income recipients are eligible for a blind work expense, Earned Income exclusion, plan for achieving self support, and property for achieving self support. Social Security Disability Insurance recipients are eligible for Impairment related work expense.
School Systems	IDEA (P.L. 105-17)	Student with a qualifying disability	A school district must pay for AT devices and services if they are deemed necessary for a free and appropriate public education
Post-Secondary Education	Rehabilitation Act Amendments (P.L. 99-506); Section 504	Student with a disability who has verified disability and need for AT	The law states that no one will be discriminated against in programs receiving federal financial assistance solely on the basis of disability. As a result, post-secondary institutions must provide accommodations to students who need them to have equal access to education.
Employer	ADA (P.L. 101-336)	Employee who needs accommodation to complete the essential functions of position	Employers are required to provide reasonable accommodation to a person with a disability who needs them to complete the essential functions of their position. Accommodation the represents an undue hardship to the company can be denied.

Funding Assistive Technology for People with Visual Impairment

Paying for assistive technology can be one of the most challenging aspects of its acquisition and use. In a survey of people with disabilities regarding federal policy barriers to assistive technology, funding was listed as one of the two largest barriers to acquiring AT (National Council on Disability, 2000). The financial situation of people with visual impairments, and disabilities in general, further magnifies the problem as many are unable to pay for expensive assistive technology devices and services out of pocket. Consider that the unemployment rates for people with visual impairments are a staggering 70% (Cleveland Sight Center, 2001), compared to 5.7% of the general population (Bureau of Labor Statistics, 2004). In addition, 28% of people ages 25-64 with a severe disability are living in poverty, as compared to 8% of people without disabilities (US Census Bureau, 2001b). The federal government has recognized that the inability to afford assistive technology can prevent many of its citizens from becoming productive members of America's communities. The following statement was listed as one of the three purposes of the Assistive Technology Act of 1998 (P.L. 105-394): "To identify federal policies that facilitate payment for assistive technology devices and assistive technology services, to identify those federal policies that impede such payment, and to eliminate inappropriate barriers to such payment (29 U.S.C. §2 S 3001 [14])." Even with this recognition by the federal government, identifying potential funding sources for assistive technology is a daunting task.

Title III of the Assistive Technology Act of 1998 (P.L. 105-394) authorized funds for the establishment of an alternative financing program for people with disabilities to obtain assistive technology. In fiscal year 2000, 3.8 million dollars appropriated to establish the funds in six states, including Kansas, Maryland, Missouri, Pennsylvania, Utah, and Virginia. Funds were dispersed through a competitive grant process and federal dollars were matched with state funds. Data from the initial program revealed that 229 people were provided with $2,309,356 in loans, primarily for "vehicle modifications, mobility equipment, computer equipment or computer access, equipment for daily living and home modifications." The median loan amount was $5000 and the default rate for loans provided was zero percent (US Department of Education, 2002). Today, alternative loan funds have been established with Title III money in 32 states and territories (see http://www.resna.org/AFTAP/state/index.html for a full listing of loan programs). Data from the Alternative Financing Programs for Assistive Technology and Telework (2004) at the University of Illinois at Chicago can be obtained from http://128.248.232.70/aftap/getstarted.htm. The survey is currently updated on a daily basis as additional results are returned. The loan programs are experiencing an exceeding high level of success. In the first year on the program, three quarters of survey respondents who received funding reported an "improved quality of life or life satisfaction" after obtaining loans for the equipment and services they needed. The majority of loans provided to survey participants were guaranteed loans. Other loans programs consist of revolving loan

programs, non-guaranteed low interest loans, interest buy down loans, traditional interest loans, and small grants. These loan programs are making it possible for many people with disabilities who could not obtain a standard bank loan, as evidenced by higher expenses to income ratios, to get the funding they need to purchase assistive technology (RESNA Alternative Financing Technical Assistance Project, 2002). Obtaining funding through this mechanism is not guaranteed, people with disabilities must apply for loans and some are denied. Some reasons for loan denial include applicants who have poor credit, a high debt to income ratio, and the need for a co-applicant. Applicants whose requests fall outside of the requirements for the loan program are also denied (Alternative Financing Programs for Assistive Technology and Telework, 2004). There are 16 states that offer loan programs through financing from other sources, information on these state programs can be obtained by visiting http://www.resna.org/AFTAP/state/otherloans.html.

The **United States Department of Veterans Affairs (VA)** will pay for assistive technology for veterans with service related disabilities when it is deemed necessary as part of the overall medical or rehabilitation intervention. In order to qualify, veterans of active service must have received an honorable or general discharge from military service (North Dakota Interagency Program for Assistive Technology (IPAT), n.d.) Additional information on eligibility is available at the US Veterans Administration website at http://www1.va.gov/elig/page.cfm?pg=1. According to the Veterans Health Administration (VHA) Handbook (2002), veterans who are blind are eligible to receive, "mechanical aids for the blind, and repairs to these aids…to overcome the physical and economic impairments associated with blindness when the veteran is enrolled under Title 38, U.S.C., Chapter 17, Section 1705." The VA has provided a broad definition of aids for the blind that includes "any prosthetic device or piece of equipment, or animal, used in assisting a legally blind or visually impaired beneficiary in overcoming the impairments associated with blindness and vision loss." The list of available technologies includes devices specially designed for people who are blind, devices designed for sighted persons but approved for people who are blind, and guide dogs (VHA Handbook, 2002).

State vocational rehabilitation agencies are charged with assisting people with disabilities who qualify for service employment in their communities. As a part of these vocational rehabilitation services, assistive technology may be purchased if necessary to enable the person to obtain or maintain paid employment. One such program in Iowa includes assessment, demonstration, and training in the Iowa Assistive Technology Resource Center to be an integral part of their vocational rehabilitation program to people with visual impairments. This center allows people to see what types of assistive technology may help them in their search for employment. Based on this information the person with a visual impairment can determine which device(s) will optimize their employment skills and help them to obtain and maintain a position in the community. The center in Iowa also provides training on how to use these technologies and how to access

computer programs with keystrokes as opposed to mouse movements (Iowa Department for the Blind, n.d.). All state vocational rehabilitation programs for the blind provide assistive technology services and devices to some degree. State vocational rehabilitation programs are considered funding sources of last resort. All expenditures are based on customer need and employment goal. For information on the project in your state, please see appendix A for contact information.

The **Social Security Administration** lists assisting people with disabilities to become more independent through employment as one of its primary goals. The employment support provisions were created to assist people with disabilities to re-enter the workforce while maintaining the safety net of cash benefits while the person moves towards financial independence (Social Security Administration (SSA), 2003). To that end, the Social Security Administration offers work incentives for both the Supplemental Security Income (SSI) program and the Social Security Disability Insurance (SSDI) program. The eligibility requirements and items that qualify for payment under the work incentives vary between programs. In order to be eligible for SSI, an individual must be elderly, blind, or have a qualifying disability. Eligible individuals must also meet income and resource limits set by SSA. For more information on eligibility for SSI benefits please see http://www.ssa.gov/pubs/11000.html. In order to be eligible for SSDI, an individual must have a qualifying disability or blindness and have contributed to the Social Security Disability insurance funds through FICA payments. FICA payments are automatically deducted by employers from gross earnings. For additional information on eligibility for SSDI programs please see http://www.socialsecurity.gov/disability/professionals/bluebook/general-info.htm.

Work incentives that are available for people who are blind that can help to pay for assistive technology under the SSI and SSDI program include (SSA, 2003):

- (SSI) **Earned Income Exclusion** (EIE) allows for the exclusion of the first $65 dollars of your earnings in a month plus one half of the remainder when figuring the cash SSI payment.
- (SSI) **Student Earned Income Exclusion** (SEIE) allows people who qualify as regularly attending school can defer up to $1,340 of earned income up to $5, 410 per year.
- (SSI and SSDI) **Impairment Related Work Expense** (IRWE) allows people who qualify as blind under the Social Security regulations to deduct items and services that allow a person to work from gross earnings prior to deciding countable earnings under the SSI program. There are a number of items that qualify as IRWE expenses, including “work related equipment and assistance”. This includes “all impairment related assistive devices, services, methods, or systems including helper animals” when not paid for by the employer. All vision and sensory aids for the blind can be excluded under an IRWE. Receipts for all approved IRWE’s must be submitted on a regular basis. For people who are visually impaired who receive SSI, the Blind Work Expense is generally considered more favorable.

- (SSI) The **Blind Work Expense** (BWE) allows people who are blind to deduct any expenses related to working, even if they are unrelated to blindness. This expensed can include assistive technology, earned income used to pay income taxes, meals consumed during work hours, transportation costs or guide dog expenses.
- (SSI) **Plan for Achieving Self Support** (PASS) allows a person with a disability to set aside money and/or resources to pay for approved items, such as assistive technology, for a specified period of time for a specific work goal. The income set aside under an approved PASS plan is not counted when determining an individuals SSI payment. People who desire a PASS plan must submit a written request that outlines the need for the item, the time frame in which the money will be saved and the means by which the PASS dollars will be kept separate from other savings.
- (SSI) **Property Essential to Self Support** (PESS) allows people with disabilities to exclude up to $6000 in property used in a trade or business or that is used as an employee of a business, such as assistive technologies, that are essential to employment success.
- (SSDI) **Trial Work Period** (TWP) allows people with disabilities to test their ability to work by paying full SSDI cash benefits for a period of 9 months regardless of earnings. This TWP continues until the beneficiary performs 9 months of work earning Substantial Gainful Activity (SGA) in a 60-month period. SGA is $1,330 a month for people who are blind.

There are other work incentives for people with disabilities under the SSI and SSDI programs. A full review of these employment supports can be found in the Social Security Publication number 64-030, entitled the *2003 Red Book: A Summary Guide to Employment Support for People with Disabilities under the Social Security Disability Insurance and Supplement Security Income Programs*. This document is available for download at http://www.ssa.gov/work/ResourcesToolkit/redbook.html.

Under the requirements of the Individuals with Disabilities Education Act, school systems must provide assistive technology devices and services to students who require them to receive a free and appropriate public education. Any device that is purchased by a school system for the benefit of a student with a disability remains the property of the school and not that of the student. Funding through IDEA has not always been delivered as promised by the legislation. Golinker (2000) states that many schools fail to provided assistive technology and services on the basis of cost. It is important that the student with a disability or an advocate who works in their interests to ensure that AT is considered in the development of each Individualized Education Program (IEP) and that the technology is acquired by the school system as mandated by the legislation. The Golinker (2000) article provides some comprehensive action steps that parents of children with disabilities can follow to ensure that AT is obtained for their child. These steps include asking for AT evaluations by the school or independent

evaluator at the schools expense; ensuring that technology is considered by attending and being an active participant in IEP meetings; obtaining education on devices that may benefit the child with a disability; and turning to the state Protection and Advocacy Organization if technology is denied to the student with a disability.

Students in grades K-12 who are not eligible for assistive technology devices and services under the Individuals with Disabilities Education Act, may be eligible under **Section 504 of the Rehabilitation Act**. This section of the law calls for non-discrimination on the basis of disability in programs receiving federal financial assistance and is applicable to both local education agencies; employers; and colleges, universities and other post-secondary institutions (Government Services Administration, 2002). While section 504 does call for reasonable accommodation for students with disabilities, it is less stringent than the requirements under IDEA. Post-secondary education institutions who receive federal financial assistance must provide accommodations to their students including students who are blind or visually impaired. Covered devices and services may include readers, brailed or large print materials, and computer accommodations (i.e. screen readers). The school must provide these services "unless doing so would result in a fundamental alteration of the program or would result in undue financial or administrative burdens," neither of these exclusionary measures are easy to document (PACER Center, 1994). Under section 504, the student with a disability is responsible for disclosure of disability and accommodation requests. In cases where the disability is not immediately apparent, the student will be asked to provide documentation of disability.

The **Americans with Disabilities Act of 1990** calls for the prohibition of discrimination for otherwise qualified applicants with disabilities in employment. Under this law, employers who have 15 or more employees for 20 or more weeks a year must provide reasonable accommodations to allow qualified applicants with disabilities to perform the essential functions of a job. Reasonable accommodations generally refer to "acquisition or modification of equipment or devices, appropriate adjustment or modifications of examinations, training materials or policies, the provision of qualified readers or interpreters, and other similar accommodations for individuals with disabilities." Additional reasonable accommodations include accessible facilities, job restructuring, reassignment to vacant positions, and part-time or modified work schedules (Equal Opportunity Employment Commission, 1997). Accommodations that present an undue hardship to employers are exempt from the law. The burden of proof for undue hardship is such that very few accommodations would be excluded under this tenet of the law.

There are some additional considerations when pursuing funding for assistive technology. For example, in cases where a third party pays for the assistive technology devices or services for a person with a disability, there is often a negotiation related to what specific device is offered. In many cases, if 3 similar

devices can be effective to complete the activity, a third party payer such as a school district or employer will choose a lower cost option. In some cases, the person with a disability can offer to offset the cost of the higher priced item in order to obtain the desired device. In cases where a student in a local educational agency is transitioning to employment, it may be beneficial to seek collaborative funding through the school district and the state vocational rehabilitation agency. A cooperative funding agreement would allow the student to take the technology with them into employment after graduation. Finally, it is important to note that some private organizations may assist in the funding of assistive technology. These organizations often have a social mission that includes serving a specific need in the community. The involvement of these groups varies among communities, depending on the specific needs of the members in the respective group's community, with fundraising being the major source of contribution. An example of this type of organization is the Lions Club. The consumer can identify local organizations by contacting the local Chamber of Commerce. Workers compensation programs may be another potential source of funding for assistive technology. States often require physical and vocational rehabilitation benefits by provided to injured workers to enable them to re-enter the workforce. Assistive technology may be purchased if deemed necessary to allow the injured worker to become employed. For additional information, please see http://www.dol.gov/esa/regs/statutes/owcp/stwclaw/stwclaw.htm.

APPENDIX A.
Manufacturers

Voice-based Products (screen & text readers, word processors, other)

Access Solutions
Phone: (916) 481-3559,
Website: http://www.axsol.com

Access USA
Phone: (800) 263- 2750,
Website: http://www.access-usa.com

Ai Squared
Phone: (802) 362-3612,
Website: http://www.aisquared.com

Apple Computer Inc.
Phone: 1-800-692-7753 (1-800-MY-APPLE),
Website:http://www.apple.com/disability/

AT&T Advanced Speech Products Group
Phone: 1-800-592-8766 (1-800-5-WATSON),
Website: http://www.att.com/aspg

BAUM Retec AG
Phone: +(49) (0) 6223-4909-0,
Website: http://www.baum.de/English/prodeng.htm

Beyond Sight
Phone: (303) 795-6455,
Website: http://www.beyondsight.com

Biolink Computer Research and Development, Ltd.
Phone: (604) 984-4099,
Website: http://www.biolink.bc.ca

CAST
Phone: (781) 245-2212,
Website: www.cast.org

BRYTECH, Inc.
Phone: (613) 731-5800,
Website: www.brytech.com

CFS-Technologies
Phone: +49 7129 694841 (Germany)
Website: http://www.cfs-technologies.com/home/?id=2.7

Cloudworld, Ltd.
Phone: 020 8987 8326 (United Kingdom)
Website: http://www.cloudworld.co.uk

Cobolt Systems Ltd.
Phone: (44) 1493-700172
Website: http://www.cobolt.co.uk

Code-it Software, Inc.
Phone: (307) 437-6629
Website: http://www.code-it.com

Compusult Limited Information Management
Phone: (709) 745-7914
Website: http://www.hear-it.com/html/products.html
Criss-Cross Technologies
Phone: (718) 268-6988
Website: http://crisscrosstech.com
Dancing Dots
Phone: (610) 783-6692
Website: www.dancingdots.com
Dolphin Computer Access Ltd.
Phone: (866) 797 5921 (USA office)
Website: http://www.dolphinusa.com
Don Johnston Special Needs Ltd.
Phone: (800) 999-4660
Website: http://www.donjohnston.com/catalog/catalog.htm
Econonet International, Inc.
Phone: (954) 345-0213
Website: http://www.econointl.com
Emacspeak, Inc.
Phone: (607) 255 7316
Website: http://emacspeak.sourceforge.net
En-Vision America
Phone: (309) 452-3088
Website: http://www.envisionamerica.com
euroBRAILLE
Phone: 011-331-53728510
Website: www.eurobraille.fr
Fonix Corporation
Phone: (978) 266-0100
Website: http://www.fonix.com
Franklin Electronic Publishers
Phone: (800) 266-5626
Website: www.franklin.com
Freedom Scientific
Phone: (760) 602-5232
Website: http://www.freedomscientific.com
GW Micro, Inc.
Phone: (219) 489-3671
Website: http://www.gwmicro.com
HP Accessibility Program
Phone: (800) 727-2472
Website: http://www.hp.com/hpinfo/abouthp/accessibility/index.html
IBM Accessibility Center
Phone: (800) 426-4968
Website: http://www-3.ibm.com/able
JBliss Imaging Systems
Phone: (408) 369-7600
Website: http://www.jbliss.com

KanSys, Inc.
Phone: (913) 843-0351
Website: http://www.kansys.com
Kurzweil Educational Systems, Inc.
Phone: (800) 894-5374
Website: http://www.kurzweiledu.com
MERU (Medical Engineering Resource Unit)
Phone: +44 (0) 0208 770 8286
Website: http://www.meru.org.uk
Metroplex Voice Computing
Phone: (817) 261-1658
Website: www.metroplexvoice.com
MicroTalk
Phone: (502) 721-9907
Website: www.microtalk.com
Mindmaker, Inc.
Phone: (408) 467-9200
Website: www.mindmaker.com
Mons International, Inc.
Phone: (800) 541-7903
Website: http://www.magnifiers.com
Next Generation Technologies, Inc.
Phone: (425) 744-1100
Website: http://www.ngtvoice.com
PLEXTOR Co., Ltd.
Phone: (+81) 335-178061 (JAPAN)
Website: www.plextor.co.jp
Portset Systems, Ltd.
Phone: 44 (0) 1489 893919
Website: http://www.portset.co.uk/us.htm
Pulse Data HumanWare International
Phone: (800) 722-3393
Website: http://www.pulsedata.com
Premier Assistive Technology, Inc.
Phone: (517) 668-8188
Website: http://www.premier-programming.com
Quillsoft, Ltd.
Phone: (416) 698-0111
Website: http://www.wordq.com
RC Systems, Inc.
Phone: (425) 355-3800
Website: http://www.rcsys.com
ReadPlease Corporation
Phone: (807) 474-7702
Website: http://www.readplease.com
Robotron, Pty.Ltd.
Phone: 00-61-3-9525-5300 (Australia)
Website: http://www.sensorytools.com

Sensory Software Ltd.
Phone: +44 (0) 1684 578868 (United Kingdom)
Website: http://www.sensorysoftware.com
Syntha-Voice Computer, Inc.
Phone: (190) 566-20565
Website: http://www.synthavoice.on.ca
Telesensory Corporation
Phone: (408) 616-8700
Website: www.telesensory.com
Telex Communications, Inc.
Phone: (952) 884-4051
Website: http://www.telex.com
Texthelp Systems, Ltd.
Phone: +44 (0) 28 9442 8105 (Northern Ireland)
Website: http://www.texthelp.com

Screen Magnification Software

Ai Squared
Phone: (802) 362-3612
Website: http://www.aisquared.com
Apple Computer Inc.
Phone: 1-800-692-7753 (1-800-MY-APPLE)
Website: http://www.apple.com/disability
BAUM Retec AG
Phone: +(49) (0) 6223-4909-0
Website: http://www.baum.de/English/prodeng.htm
Biolink Computer Research and Development, Ltd.
Phone: (604) 984-4099
Website: http://www.biolink.bc.ca
Dolphin Computer Access Ltd.
Phone: (866) 797 5921 (USA office)
Website: http://www.dolphinusa.com
Freedom Scientific
Phone: (760) 602-5232
Website: http://www.freedomscientific.com
JBliss Imaging Systems
Phone: (408) 369-7600
Website: http://www.jbliss.com
Kurzweil Educational Systems, Inc.
Phone: (800) 894-5374
Website: http://www.kurzweiledu.com

Large Print/Display Products

Access USA
Phone: (800) 263- 2750
Website: http://www.access-usa.com
Ann Morris Enterprises, Inc.
Phone: (914) 227-9659, (800) 267-5350
Website: http://www.annmorris.com

Betacom Corporation
Phone: (905) 568-9977
Website: http://www.betacom.com
Hooleon, Inc.
Phone: (800) 937-1337
Website: http://www.hooleon.com
Papenmeier GmbH & Co KG
Phone: 49 2304 946-0 (Germany)
Website: http://www.papenmeier.de
Tactile Vision, Inc.
Phone: (905) 465-0755
Website: www.tactilevisioninc.com

Braille Note Takers, Displays
ALVA Access Group, Inc.
Phone: (888) 318-2582
Website: http://www.aagi.com
BAUM Retec AG
Phone: +(49) (0) 6223-4909-0
Website: http://www.baum.de/English/prodeng.htm
euroBRAILLE
Phone: 011-331-53728510 (France)
Website: www.eurobraille.fr
Freedom Scientific
Phone: (760) 602-5232
Website: http://www.freedomscientific.com
Optelec USA, Inc.
Phone: (978) 392-0707 ext. 100, (800) 828-1056
Website: http://www.optelec.com
Papenmeier GmbH & Co KG
Phone: 49 2304 946-0 (Germany)
Website: http://www.papenmeier.de
Pulse Data HumanWare International
Phone: (800) 722-3393
Website: http://www.pulsedata.com
Robotron, Pty.Ltd.
Phone: 00-61-3-9525-5300 (Australia)
Website: http://www.sensorytools.com

Tactile Production (embossers, thermoform)
Access USA
Phone: (800) 263- 2750
Website: http://www.access-usa.com
American Printing House for the Blind
Phone: (800) 223-1839, (502) 895-2405
Website: http://www.aph.org
American Thermoform Corporation
Phone: (800) 331-3676
Website: http://www.atcbrlegp.com

Blista-Brailletec GGmbH
Phone: 011-49-642-018020
Website: http://www.brailletec.de/home_en.htm
Braillo Norway AS
Phone: 33 31 66 22 (Norway)
Website: http://www.braillo.com
Enabling Technologies
Phone: (561) 225-3687
Website: http://www.brailler.com
Freedom Scientific
Phone: (760) 602-5232
Website: http://www.freedomscientific.com
Quantum Technologies
Phone: (800) 722-3393 (US)
Website: http://www.quantech.com.au
Repro-Tronics, Inc.
Phone: (800) 948-8453, (201) 722-1880
Website: http://www.repro-tronics.com
Sighted Electronics Inc.
Phone: (201) 666-2221
Website: http://www.sighted.com
Tack-Tile Braille Systems, LLC
Phone: (603) 382-1904
Website: http://www.tack-tiles.com
Tactile Vision, Inc.
Phone: (905) 465-0755
Website: www.tactilevisioninc.com
ViewPlus Technologies
Phone: (541) 754-4002
Website: http://www.viewplustech.com
VirTouch Ltd./Performance Systems
Phone: (713) 723-6000
Website: www.virtouch.co.il

Text to Braille Translation
Dolphin Computer Access Ltd.
Phone: (866) 797 5921 (USA office)
Website: http://www.dolphinusa.com
Duxbury Systems, Inc.
Phone: (978) 692-3000
Website: http://www.duxburysystems.com
Quantum Technologies
Phone: (800) 722-3393 (US)
Website: http://www.quantech.com.au

Video Telescopes, Magnifiers, *Captioning*
Access USA
Phone: (800) 263- 2750
Website: http://www.access-usa.com

Ash Technologies
Phone: (International) +353-45-88 22 12
Website: http://www.ashtech.ie
BAUM Retec AG
Phone: +(49) (0) 6223-4909-0
Website: http://www.baum.de/English/prodeng.htm
Betacom Corporation
Phone: (905) 568-9977
Website: http://www.betacom.com/
Clarity
Phone: (800) 575-1456
Website: http://www.clarityusa.com
Compusult Limited Information Management
Phone: (709) 745-7914
Website: http://www.hear-it.com/html/products.html
Dazor Manufacturing Corporation
Phone: (800) 345-9103
Website: http://www.dazor.com
Enhanced Vision Systems
Phone: (309) 452-3088
Website: http://www.enhancedvision.com
Eschenbach Optik of America, Inc.
Phone: (877) 422-7300
Website: http://www.eschenbach.com
IBM Accessibility Center
Phone: (800) 426-4968
Website: http://www-3.ibm.com/able
Innoventions, Inc.
Phone: (800) 854-6554
Website: http://www.magnicam.com
Low Vision International
Phone: +46 470-727700 (Sweden)
Website: www.lvi.se
MagniSight, Inc.
Phone: (719) 578-8893
Website: www.magnisight.com
Optelec USA, Inc.
Phone: (978) 392-0707 ext. 100, (800) 828-1056
Website: http://www.optelec.com
OVAC, Inc.
Phone: (800) 325-4488
Website: http://www.ovac.com
Pulse Data HumanWare International
Phone: (800) 722-3393
Website: http://www.pulsedata.com
Sighted Electronics Inc.
Phone: (201) 666-2221
Website: http://www.sighted.com

Telesensory Corporation
Phone: (408) 616-8700
Website: www.telesensory.com
Vision Technology, Inc.
Phone: (800) 560-7226
Website: http://www.visiontechinc.com/index.htm

Optical Magnifiers, Telescopes
Allied Technologies, Inc.
Phone: (764) 425-9889, (800) 267-5350
Website: http://www.alliedtec.com
Betacom Corporation
Phone: (905) 568-9977
Website: http://www.betacom.com
Dazor Manufacturing Corporation
Phone: (800) 345-9103
Website: http://www.dazor.com
Eschenbach Optik of America, Inc.
Phone: (877) 422-7300
Website: http://www.eschenbach.com
Keeler Instruments, Inc.
Phone: (800) 523-5620
Website: http://www.keelerusa.com
Manning Holoff Co.
Phone: (818) 988-3185
Website: http://www.magna-lite.com
Optelec USA, Inc.
Phone: (978) 392-0707 ext. 100, (800) 828-1056
Website: http://www.optelec.com

Wayfinding: Canes, GPS/GIS, other
Ambutech
Phone: (800) 561-3340
Website: http://www.ambutech.com
Nurion-Raycal Industries
Phone: (610) 640-2345
Website: http://www.nurion.net
Talking Signs, Inc.
Phone: (800) 339-0117
Website: www.talkingsigns.com

"Other" aids, educational tools
Allied Technologies, Inc.
Phone: (764) 425-9889, (800) 267-5350
Website: http://www.alliedtec.com
American Printing House for the Blind
Phone: (800) 223-1839, (502) 895-2405
Website: http://www.aph.org
Ann Morris Enterprises, Inc.

Phone: (914) 227-9659, (800) 267-5350
Website: http://www.annmorris.com

Attainment Company
Phone: (800) 327-4269
Website: www.attainmentcompany.com

Betacom Corporation
Phone: (905) 568-9977
Website: http://www.betacom.com

BRYTECH, Inc.
Phone: (613) 731-5800
Website: www.brytech.com

Cobolt Systems Ltd.
Phone: (44) 1493-700172
Website: http://www.cobolt.co.uk

Dancing Dots
Phone: (610) 783-6692
Website: www.dancingdots.com

InfoCon, Inc.
Phone: (209) 478-7075
Website: http://www.infocon.com

Low Vision International
Phone: +46 470-727700 (Sweden)
Website: www.lvi.se

Manning Holoff Co.
Phone: (818) 988-3185
Website: http://www.magna-lite.com

Mons International, Inc.
Phone: (800) 541-7903
Website: http://www.magnifiers.com

Portset Systems, Ltd.
Phone: 44 (0) 1489 893919
Website: http://www.portset.co.uk/us.htm

Quantum Technologies
Phone: (800) 722-3393 (US)
Website: http://www.quantech.com.au

Recording for the Blind & Dyslexic
Phone: (609) 520-8080
Website: www.rfbd.org

R J Cooper and Associates
Phone: (800) 752-6673
Website: http://www.rjcooper.com

Science Products for the Blind
Phone: (800) 888-7400

Sensory Software Ltd.
Phone: +44 (0) 1684 578868 (United Kingdom)
Website: http://www.sensorysoftware.com

Synapse Adaptive
Phone: (800) 317-9611
Website: http://www.synapseadaptive.com

Tack-Tile Braille Systems, LLC
Phone: (603) 382-1904
Website: http://www.tack-tiles.com
TechAssist
Website: http://www.jawbonesoftware.com

APPENDIX B.
Sources of Financial Aid for Eye Care

American Academy of Ophthalmology
National Eye Care Project
P.O. Box 7424
655 Beach Street
San Francisco, CA 94120-7424
(800) 222-3937
http://www.aao.org
The American Academy of Ophthalmology provides referrals for people over the age of 65 who do not have and cannot afford to see an ophthalmologist.

American Optometric Association
243 North Lindbergh Blvd
St. Louis, MO 63141
(314) 991-4100
http://www.aoanet.org
The American Optometric Association sponsors Vision USA, a program offering free eye exams during the month of March. Call (800) 766-4466 in January only to apply.

The Hill Burton Program
Health Resources and Services Administration
5600 Fishers Lane, Room 11-19
Rockville, MD 20857
(301) 443-5656
(800) 638-0742
(800) 492-0329 in Maryland only
Participating hospitals and other health care facilities provide medical care for free, or at reduced cost, to those who meet eligibility requirements. Procedures covered vary from hospital to hospital.

National Eye Care Project
PO Box 429098
San Francisco, CA 94142-9098
(415) 561-8500
(800) 222-3937
The National Eye Care Project offers medical and surgical assistance to financially disadvantaged persons 65 and older who are not currently under care of an ophthalmologist and is a resource for information on eye diseases. No eyeglasses are distributed.

New Eyes for the Needy, Inc.
549 Millburn Avenue
P.O. Box 332
Short Hills, NJ 07078
(973) 376-4903
This organization accepts donations of used prescription eyeglasses and distributes them to persons with limited incomes. Recipients must have a letter of referral from a social services agency.

The Pearle Vision Foundation
2534 Royal Lane
Dallas, TX 75229
(972) 277-5000
(972) 277-5992
http://www.pearlevision.com/
The Pearle Vision Foundation awards funds to individuals who demonstrate financial hardship and are in need of vision care and equipment.

Sight for Students
(888) 290-4964
http://www.sightforstudents.org/
Sight for Students provides eye exams and glasses to children 18 years and younger whose families cannot afford vision care.

U.S. Department of Veterans Affairs
http://www.va.gov/publ/direc/health/handbook/1121hb(7-5-02).pdf
http://www.techaccess-ri.org/atfundva.htm
The Department of Veterans Affairs pays for at least part of an assistive device for veterans with blindness. Veterans who are blind can receive funds to help pay for specially adapted housing. The veteran must have a "service-connected" disability to receive these funds. Adaptive equipment including equipment for guide dogs may also be provided for veterans who are blind and entitled to disability income benefits. The VA can help pay for the cost of maintenance and medical care for a guide dog.

Local/Community Agencies for Eye Care Financial Aid

County Medical Society
State Ophthalmological Society
Sources and services of county medical societies are specific to state, provide referrals to ophthalmologists. Some medical societies and ophthalmologic societies maintain listings of practices that accept Medicaid or Medicare, or provide free or low-cost eye examinations. A list of state ophthalmologic societies is available at the following link:
http://www.aao.org/aao/member/state/directory.cfm

The Knights Templar Eye Foundation
Headquarters
P.O. Box 579
Springfield, IL 62705-0579
(217) 523-3838
http://www.knightstemplar.org/ktef/
The Knights Templar Eye Foundation helps individuals who cannot afford surgery and who are not eligible for government-funded health care. Local chapters are listed in the phone book under "fraternal organizations."

Lions Club International
300 22nd Street
Oak Brook, IL 60523-8842
(800) 747-4448
http://www.lionnet.com
Many Lions Clubs have chosen vision care as their primary charitable focus. The availability of Lions services and eligibility requirements vary from community to community. Use your local telephone directory (see Fraternal Organizations) to find local chapters.

State Optometric Associations
Services and support provided by the many state optometric associations are specific to each state. Some optometric associations have information about local programs that provide free or low-cost eye examinations. A listing of state optometric associations is available at the following link:
http://www.futureoptometrist.com/state_optometric_associations.htm

Sunshine Foundation
1041 Mill Creek Drive
Feasterville, PA 19053
(215) 396-4770
http://www.sunshinefoundation.org
The Sunshine Foundation will pay for at least part of the cost for a device and also gives devices free of charge. This foundation grants wishes to children ages three to 21 with chronic diseases, terminal illnesses or disabilities. Limit is one wish per child.

Grants-in-Aid for Adaptive Equipment

Braille Institute of America, Inc.
741 North Vermont Avenue
Los Angeles, CA 90029
(323) 663-1111
http://www.brailleinstitute.org

The Braille Institute provides financial subsidies for electronic equipment. These funds are limited to those who are employed or have a hire date for employment, and are residents of Southern California.

Foundation for the Advancement of the Blind
4058 Moore Street
Los Angeles, CA 90066
(310) 301-0344
This foundation provides funds for persons with visual impairments who want to purchase assistive devices. To qualify, the applicants must specify what equipment they are interested in, how much the device will cost, and how they plan on using the device. The applicant must also be a U.S. citizen.

International Association of Lions Clubs
300 22nd Street
Oak Brook, IL 60523-8842
(800) 747-4448
http://www.lionnet.com
Many Lions Clubs provide vocational assistance to persons who are legally blind. The international office refers requests for equipment or other assistance to the appropriate district offices.

National Federation of the Blind
Contact: Curtis Chong
1800 Johnson Street
Baltimore, MD 21230
(410) 659-9314
http://www.nfb.org
The NFB provides low interest loans for the purchase of adaptive equipment.

Opportunities for the Blind, Inc.
Attn: Grant Committee
P.O. Box 510
Leonardtown, MD 20650
(301) 475-1689
(800) 884-1990
http://www.opportunitiesfortheblind.org/info.htm
Opportunities for the Blind, Inc. provides funding for aids and adaptive equipment to persons who are blind. To qualify, the applicant needs to be a U.S. citizen who wishes to purchase equipment that will assist him or her in achieving employment or educational goals.

Telesensory Corp.
520 Almanor Avenue
Sunnyvale, CA 94086

(800) 227-8418
http://www.telesensory.com
The American College for the Blind (2000) states that Telesensory occasionally offers refurbished video magnifiers and scanning equipment for sale at reduced prices. Telesensory offers extended payment plans, ranging from 22-24 months, are available for new equipment in cooperation with Allegro.

State/Local Administration and Programs

Assistive Technology Programs

There are assistive technology programs in each state. These programs may provide one or more of the following services: assistance in obtaining funds for assistive devices and services; equipment demonstration center; equipment exchange and recycling program; contact information for financial loan program for the purchase of assistive technology and services; and mobile van outreach service. A list of state assistive technology programs is available at: http://www.resna.org/taproject/at/statecontacts.html

Social Security Disability Insurance (SSDI) Benefits

Social Security Administration
6401 Security Boulevard
Baltimore, MD 21235
(800) 772-1213
http://www.ssa.gov
For information about eligibility requirements and benefits for workers who have become disabled or visually impaired, please contact the above address. People are considered to be legally blind under Social Security rules if vision cannot be corrected to better than 20/200 in the better eye, or if visual field is 20 degrees or less, even with a corrective lens. If the definition for legal blindness is not met, a person may still qualify for disability benefits if vision problems alone or combined with other health problems prevent an individual from working. As a general rule, you need credits equal to the number of years after 1950 up to the year you are determined to be disabled based on blindness. If blind, you can earn credits anytime during your working years.

Supplemental Security Income (SSI)

Social Security Administration
6401 Security Boulevard
Baltimore, MD 21235
(800) 772-1213
http://www.ssa.gov
Contact the above address to learn more about the eligibility requirements and benefits for persons who are visually impaired or disabled. Recipients must also have limited financial resources. A person is considered to be legally blind under Social Security rules if vision cannot be corrected to better than 20/200 in the

better eye, or if visual field is 20 degrees or less, even with a corrective lens. If the definition for legal blindness is not met, individuals may still qualify for disability benefits if vision problems alone or combined with other health problems prevent an individual from working.

State Vocational Rehabilitation Agencies
http://www.nls.org/vrbooklt.htm
Vocational rehabilitation agencies can fund a wide range of goods and services, including "rehabilitation technology" (i.e. AT), that are connected to a person's vocational goal. Any service an individual is to receive from the VR system must be connected to an ultimate employment goal.

Additional Sources of Information

National Rehabilitation Information Center (NARIC)
1010 Wayne Ave., Suite 800
Silver Spring, MD 20910.
V: (800) 346-2742
TTY: (301) 495-5626
http://www.naric.com
NARIC is responsible for the collection and dissemination of results from federally funded rehabilitation projects. As a result they have a wealth of information on all topics related to rehabilitation.

APPENDIX C.
State and Provincial Services

STATE SERVICES FOR THE BLIND

Alabama
Vocational Rehabilitation Service
2129 East South Boulevard
Montgomery, AL 36116-2455
(334) 281-8780
http://www.rehab.state.al.us/Home/

Alaska
Division of Vocational Rehabilitation
801 W. 10th Street, Suite A
Juneau, AK 99801-1894
(907) 465-2814
http://www.labor.state.ak.us/dvr/blsvs.htm

Arizona
Department of Economic Security
Rehabilitation Services Administration
1789 West Jefferson Street, 2nd Floor
Phoenix, AZ 85007
(602) 542- 3332
http://www.de.state.az.us/rsa/blind.asp

Arkansas
Arkansas Department of Human Services
Division of Services for the Blind
700 Main Street
P.O. Box 3237
Little Rock, AR 72203
(501) 682-5463
http://www.state.ar.us/dhs/dsb/

California
Department of Rehabilitation
P.O. Box 944222
2000 Evergreen Street
Sacramento, CA 95815
(916) 263-8981
http://www.rehab.cahwnet.gov/ssd/blindser.htm

Colorado
Department of Human Services
Division of Vocational Rehabilitation
2211 West Evans, Bldg. B
Denver, CO 80223
(720) 884-1234
http://www.cdhs.state.co.us/ods/dvr/ods_dvr1.html

District of Columbia
Vocational Rehabilitation Services
810 First Street, North East, 9th Floor
Washington, DC 20002
(202) 442-8738
http://film.dc.gov/dhs/cwp/view.asp?a=3&Q=492432&dhsNAV=|30989|

Connecticut
Board of Education & Services for the Blind
184 Windsor Avenue
Windsor, CT 06095
(860) 602-4000
http://www.besb.state.ct.us/

Delaware
Division for the Visually Impaired
Biggs Building
Health & Social Service Campus
1901 North DuPont Highway New
Castle, DE 19720
(302) 255-9800
http://www.state.de.us/dhss/dvi/dvihome.htm

Florida
Division of Blind Services
Department of Education
2551 Executive Center Circle, W.
Tallahassee, FL 32399
(850) 488-1330
http://www.state.fl.us/dbs/disoff.html

Georgia
Division of Rehabilitation Services
State Office
148 Andrew Young International Blvd.
Suite 510
Atlanta, GA 30303-1751
(404) 657-3000

http://www.vocrehabga.org/

Hawaii
Hawaii Department of Human Services
Division of Vocational Rehabilitation
Ho'opono Services for the Blind
1901 Bachelot Street
Honolulu, HI 96817
(808) 586-5268
http://www.state.hi.us/dhs/vr.pdf

Idaho
Idaho Commission for the Blind
341 West Washington Street
Boise, ID 83702
(208) 334-3220
http://www.icbvi.state.id.us/

Illinois
Illinois Dept. of Rehabilitation Services
Bureau of Blind Services
623 East Adams Street
Springfield, IL 62794
(217) 785-3887
http://www.dhs.state.il.us/ors/bbs/

Indiana
Blind and Visually Impaired Services
Indiana Family and Social Services Administration
Indiana Government Center
402 West Washington Street
P. O. Box 7083
Indianapolis, Indiana 46207-7083
317-232-1433
http://www.in.gov/fssa/servicedisabl/blind/index.html

Iowa
Department for the Blind
524 4th Street
Des Moines, IA 50309-2364
(515) 281- 1333
http://www.blind.state.ia.us/

Kansas
Kansas Services for the Blind and Visually Impaired
2601 SW East Circle Drive North
Kanza Business and Technology Park
Topeka, KS 66606-1703
(785) 296-3311
http://www.srskansas.org/rehab/text/SBVI.htm

Kentucky
Kentucky Department for the Blind
P.O. Box 757
209 St. Clair Street
Frankfort, KY 40602-0757
(502) 564-4754
http://blind.ky.gov/

Louisiana
Louisiana Rehabilitation Services
8225 Florida Blvd.
Baton Rouge, LA 70806
(225) 925-3594
http://www.dss.state.la.us/

Maine
Division of Vocational Rehabilitation
Administrative Office
150 State House Station
Augusta, ME 04333-0150
(207) 624-5950
http://www.state.me.us/rehab/

Maryland
Division of Vocational Rehabilitation
Administrative Offices
2301 Argonne Drive
Baltimore, MD 21218
(410) 554-9385
http://www.dors.state.md.us/

Massachusetts
Massachusetts Commission for the Blind
88 Kingston Street
Boston, MA 02111-2227
(617) 727-5550
http://www.state.ma.us/mcb/

Michigan
Commission for the Blind
Department of Labor
201 North Washington Square
Lansing, MI 48909
(517) 373-2062
http://www.michigan.gov/cis/0,1607,7-154-28077_28313---,00.html

Minnesota
State Services for the Blind
2200 University Ave. Suite 240
St. Paul, MN 55114
(651) 642-0500
http://www.mnssb.org/

Mississippi
Mississippi Department of Rehabilitation Services
P. O. Box 1698
Jackson, MS 39215
(601) 853-5100
http://www.mdrs.state.ms.us/

Missouri
Missouri Rehabilitation Services For The Blind
P.O. Box 88
3418 Knipp
Jefferson City, MO 65103-0088
(573) 751-4249
http://www.dss.mo.gov/dfs/rehab/

Montana
Department of Social & Rehabilitation Services
Rehabilitation/Visual Services Division
P.O. Box 4210
111 Sanders
Helena, MT 59604
(406) 444-2590
http://www.dphhs.state.mt.us/dsd/index.htm

Nebraska
Services for the Visually Impaired
Department of Public Institutions
4600 Valley Road
Lincoln, NB 68510-4844
(402) 471-2891
http://www.ncbvi.state.ne.us/

Nevada
Bureau of Services to the Blind and Visually Impaired
1933 North Carson Street
Carson City, NV 89706
(775) 684-0432
http://detr.state.nv.us/rehab/reh_bvi.htm

New Hampshire
State Department of Education
Rehabilitation Services for Blind and Visually Impaired
78 Regional Drive
Concord, NH 03301
(603) 271-3537
http://www.nhbvi.com/SBVI/

New Jersey
Commission for the Blind and Visually Impaired
P.O. Box 47017
153 Halsey Street
Newark, NJ 07102
(973) 648-2324
http://www.state.nj.us/humanservices/cbvi/index.html

New Mexico
Commission for the Blind
Pera Building, Room 205
Santa Fe, NM 87503
(505) 827-4479
http://www.state.nm.us/cftb/

New York
Office of Children and Family Services
Commission for the Blind & Visually Handicapped
52 Washington Street
Rensselaer, NY 12144
(518) 473-1675
http://www.ocfs.state.ny.us/main/cbvh/default.htm

North Carolina
Division of Services for the Blind
2601 Mail Service Center
309 Ashe Avenue – Fisher Building
Raleigh, NC 27699
(919) 733-9822
http://www.dhhs.state.nc.us/dsb/

North Dakota
North Dakota Department of Human Services
Disability Services Office
600 South 2nd Street, Suite 1A
Bismarck, ND 58504
(701) 328-8950
http://www.state.nd.us/humanservices/services/disabilities/vr/

Ohio
Ohio Rehabilitation Services Commission
Bureau of Services for the Visually Impaired
400 East Campus View Boulevard
Columbus, OH 43235-4604
(614) 438-1255
http://www.state.oh.us/rsc/VR_Services/BSVI/bsvi.asp

Oklahoma
Division of Visual Services
Oklahoma Department of Rehabilitation Services
3535 N.W. 58th Street, Suite 500
Oklahoma City, OK 73112
(405) 951-3400
http://www.okrehab.org/searchfiles/blindness-SD.htm

Oregon
Oregon Commission for the Blind
535 S.E. 12th Avenue
Portland, OR 97214-2488
(888) 202-5463
http://www.cfb.state.or.us/

Pennsylvania
Pennsylvania Bureau of Blindness and Visual Services
Harrisburg District Office
2971-B North 7th Street
Harrisburg, PA 17110
(717) 787-7500
http://www.dli.state.pa.us/landi/cwp/view.asp?a=128&Q=190368

Rhode Island
Rhode Island States Services for the Blind & Visually Impaired
Department of Human Services
40 Fountain Street
Providence, RI 02903
(401) 222-2300

http://www.ors.ri.gov/

South Carolina
Commission for the Blind
P. O. Box 79
1430 Confederate Avenue
Columbia, SC 29202
(800) 922-2222
http://www.sccb.state.sc.us/

South Dakota
Division of Service to the Blind and Visually Impaired
South Dakota Department of Human Services
East Highway 34
C/O 500 East Capitol
Pierre, SD 57501-5070
(605) 773-4644
http://www.state.sd.us/dhs/Sbvi/

Texas
Texas Commission for the Blind
4800 N. Lamar Blvd Suite #340
Austin, TX 78756-3178
(800) 252-5204
http://www.tcb.state.tx.us/

Utah
Division of Services for the Blind and Visually Handicapped
250 North 1950 West Suite B
Salt Lake City, UT 84111-7902
(801) 538-7530
http://www.hsdspd.state.ut.us/

Vermont
Vermont Division for the Blind & Visually Impaired
Osgood Building
103 South Main Street
Waterbury, VT 05671-2304
(802) 241-2210
http://www.dad.state.vt.us/dbvi/

Virginia
Virginia Department for the Visually Handicapped
Commonwealth of Virginia
397 Azalea Avenue
Richmond, VA 23227-3697

(804) 371-3140
http://www.vdbvi.org/

Washington
Department of Services for the Blind
402 Legion Way SE, Suite 100
P.O. Box 40933
Olympia, WA 98504-0933
(360) 586-1224
http://www.dsb.wa.gov/

West Virginia
Division of Rehabilitation Services
State Board of Rehabilitation State
Capitol Complex Charleston, WV 25305
(304) 766-4891
http://www.wvdrs.org/

Wisconsin
Department of Health and Family Services
Bureau for the Blind
1 West Wilson Street
PO Box 7851
Madison, WI 53707-7851
(608) 266-3109
http://www.dhfs.state.wi.us/blind/StateWIsvcs.htm

Wyoming
Division of Vocational Rehabilitation
Department of Employment
1100 Herschler Building
Cheyenne, WY 82002
(307) 777-7389
http://wydoe.state.wy.us/doe.asp?ID=5

CANADIAN PROVINCIAL SERVICES FOR THE BLIND

The Canadian National Institute for the Blind (CNIB)
1929 Bayview Avenue
Toronto, ON M4G 3E8
416-486-2500
Fax 416-480-7677
http://www.cnib.ca/eng/

Alberta - Northwest Territories Division

12010 Jasper Avenue
Edmonton, AB
T5K OP3
(403) 488-4871

British Columbia - Yukon Division
100-5055 Joyce Street
Vancouver, BC V5R 6B2
(604) 431-2020

CNIB Library for the Blind
1929 Bayview Avenue
Toronto, ON
M4G 3E8
(416) 480- 7700
http://www.cnib.ca/library/general_information/index.htm

Manitoba Division
1080 Portage Avenue
Winnipeg, MB
R3G 3M3
(204) 774-5421

New Brunswick Division
231 Saunders Street
Fredericton, NB
E3B 1N6
(506) 458-0060

Newfoundland and Labrador Division
70 The Boulevard
St. John's, NF
AlA 1K2
(709) 754-1180

Nova Scotia - Prince Edward Island Division
6136 Almon Street
Halifax, NS
B3K 1T8
(902) 453-1480

Ontario Division
Toronto District Office
939 Eglinton Ave. E. Unit 100-101
Toronto, Ontario M4G 4E8
(416) 413-9480

Quebec Division
Quebec Division
2155 Guy Street, Suite 750
Montreal, QC H3H 2R9
(514) 934-4622

Saskatchewan Division
2550 Broad Street
Regina, SK
S4P 3Z4
(306) 525-2571

APPENDIX D.
Conferences and Trade Shows

Aging Retina
Bi-Annual Meeting
Schepens Eye Research Institute
http://www.agingeye.org/

American Academy of Ophthalmology
Annual Meeting and Retina Subspecialty Day
http://www.aao.org

American Academy of Optometry
Annual Meeting
http://www.aaopt.org/

American Association for Pediatric Ophthalmology and Strabismus
AAPOS Annual Meeting
http://med-aapos.bu.edu/

American Association of the Deaf-Blind
AADB Annual Conference
(510) 797-3213
http://www.tr.wou.edu/dblink/aadb.htm

American Council of the Blind
Annual National Convention
(900) 424-8666
http://www.acb.org/convention/index.html

American Optometric Association
Annual Congress
http://www.aonet.org

Assistive Technology Industry Association
ATIA Conference
Orlando, FL [January]
http://www.atia.org/

Association for Education and Rehabilitation of the Blind and Visually Impaired
AER Annual Meeting
(703) 823-9690
http://www.aerbvi.org

Association for Research in Vision and Ophthalmology
ARVO Annual Meeting
(301) 571-1844
http://www.arvo.org

Association for the Advancement of Assistive Technology in Europe
AAATE Bi-Annual Conference
http://www.fernuni-hagen.de/FTB/AAATE.html

California State University at Northridge (CSUN)
Technology for Persons with Disabilities Annual Conference
Los Angeles, CA [March]
www.csun.edu/cod/

Closing the Gap, Inc.
Annual Conference
Minneapolis, MN [October]
http://www.closingthegap.com

Club Jules Gonin International Ophthalmology Congress
Annual European Meeting
(+41 21) 626-8830
www.clubjulesgonin.com

Council for Exceptional Children (CEC)
Annual Convention and Expo
(888) 232-7733
http://www.cec.sped.org/

Deaf-blind International
World Conference of DbI
http://www.dbiconferencecanada.com/index2.htm

Discovery 2002 – The Low Vision Conference
Bi-annual Conference
http://www.deicke.org/graphics/news-full.html

European Association for Vision and Eye Research
Joint European Annual Research Meetings in Ophthalmology and Vision
Alicante, Spain
http://www.ever.be

International Council for Education of People with Visual Impairments
ICEVI New Visions: Moving Toward an Inclusive Community
http://www.icevi-europe.org/calendar/icevi2002/announce.html

International Society for Low-Vision Research and Rehabilitation
ISLRR Conference
London, England
http://www.rnib.org.uk/

International Vision Expo (East)
Annual Expo
New York City, NY
http://www.visionexpo.com

International Vision Expo (West)
Annual Expo
Las Vegas, Nevada
http://www.visionexpo.com

Nantucket Retina Annual Meeting
Nantucket, MA
Contact: Donald J. D' Amico, MD
(617) 573-3291
djdamico@meei.havard.edu

National Federation of the Blind
Annual Convention
(410) 659-9314
http://www.nfb.org/2002schedule.htm

National Industries for the Blind (NIB) Association
Annual Training Conference
(703) 998-0770
http://www.nib.org

National Optometric Association
Annual Convention
http://www.natoptassoc.org

Optical Society of America
Annual Meeting and Exhibit
http://www.osa.org/meetings/annual/

Rehabilitation Engineering Society of North America
Annual Meeting
Ph: (703) 524-6686
TTY: (703) 524-6639
http://www.resna.org

Rehabilitation Research and Training Center on Blindness and Low Vision's National Conference
(662) 325-3304
http://www.blind.msstate.edu/conference.html

Retina Society
Annual Meeting
(617) 227-8767
http://www.retinasociety.org

Retinal Degenerations
International Symposium on Retinal Degeneration
http://www.ouhsc.edu/

Touch, Blindness, and Neuroscience
http://www.bham.ac.uk/symon/touch_blind.htm

Vision Loss in the 21st Century: Everybody's Business
American Foundation for the Blind and Foundation for the Junior Blind
http://www.visionloss2003.org/

Visions 2002: The Annual Conference of the Foundation for Fighting Blindness
Tel: 410-568-0150 or 888-394-3937
info@blindness.org
http://www.blindness.org

Vision 2005
International Society for Low Vision Research and Rehabilitation
Tel: 0845-702-3153
Cservices@rnib.org.uk (UK customers)
Exports@rnib.org.uk (overseas customers)
http://www.rnib.org.uk

Visual Sciences Society (VSS)
Annual Meeting
http://www.vision-sciences.org/

APPENDIX E.
Associations

Academy for Certification of Vision Rehabilitation and Education Professionals
P.O. Box 91047
Tucson, AZ 85752-1047
(520) 887-6816
http://www.acvrep.org
The academy generally assists federal and state governments in improving the public health and safety by supporting quality services to individuals who are blind or visually impaired. They serve to promote standards of excellence for professionals involved in the delivery of vision rehabilitation and education services.

Achromatopsia Network
P.O. Box 214
Berkeley, CA 94701
(510) 540-4700
http://www.achromat.org
The Achromatopsia Network is a nonprofit organization that is committed to sharing information about achromatopsia and providing resources to meet the needs of those affected by this condition, including the families of those with the condition.

American Academy of Ophthalmology
P.O. Box 7424
San Francisco, CA 94120-7424
(415) 561-8533
http://www.aao.org
The American Academy of Ophthalmology is the largest national membership association of ophthalmologists (medical doctors who provide comprehensive eye care, including medical, surgical and optical care). The academy distributes information on eye disorders and low vision.

American Action Fund for Blind Children of Adults
18440 Oxnard Street
Tarzana, CA 91356
(818) 343-2022
The American Action Fund for Blind Children and Adults was previously known as the American Brotherhood for the Blind until the 1990's. They offer charitable and educational funds, braille assistive devices, and a library for those with visual impairments. Information about the American Brotherhood for the Blind can be found at http://www.actionfund.org/aboutaaf.htm.

American Association of the Deaf-Blind
814 Thayer Avenue
Room 302
Silver Spring, MD 20910
http://www.aadb.org/
The American Association of the Deaf-Blind is a nonprofit society of persons with deaf-blindness and other concerned individuals. The association was organized for the purpose of advancing the economic, educational, and social welfare of individuals with deaf-blindness, and improving morale among persons with deaf-blindness.

American Council of Blind Lions
1155 15th Street, NW Suite 720
Washington, DC 20005
(202) 467-5081
(800) 424-8666
The American Council of Blind Lion educates Lions Club members about the needs and capabilities of people with blindness, exchanges information concerning club activities in the field of work for those who are blind, and encourages people with blindness to join Lions Clubs and other civic activities.

American Council of the Blind
1155 15th Street, NW, Suite 1004
Washington, DC 20005
(202) 467-5081
(800) 424-8666
http://www.acb.org/
The American Council of the Blind provides information and referrals, legislative and disability related advocacy, and publishes a monthly magazine, The Braille Forum, in various accessible media.

American Foundation for the Blind
11 Penn Plaza, Suite 300
New York, NY 10001
(212) 502-7600
(800) 232-5463
http://www.afb.org/
The American Foundation for the Blind publishes books, operates a national clearinghouse on blindness and visual impairment, and makes referrals to low vision centers.

American Optometric Association
243 N. Lindbergh Blvd.
St. Louis, MO 63141
(314) 991-4100
http://www.aoanet.org/

American Optometric Association provides information on low vision and maintains a list by state of members who specialize in low vision. They may be contacted to request the list for specific areas.

American Society of Cataract and Refractive Surgery
4000 Legato Road, Suite 850
Fairfax, VA 22033
(703) 591-2220
http://www.ascrs.org/
ASCRS is an international educational and scientific organization whose 7,000 member ophthalmologists specialize in cataract and refractive surgery. ASCRS has data on intraocular implantation, performs research and promotes continuing education of ophthalmologists. Brochures are available on cataract surgery and radial keratotomy.

The Associated Blind, Inc.
135 W 23rd Street
New York, NY 10011
(212) 255-1122
www.tabinc.org
This organization is dedicated to fostering economic and social independence among individuals who are blind or visually impaired. Services include adaptive computer education, information, referrals and life enrichment programs.

Associated Services for the Blind
919 Walnut Street
4th Floor
Philadelphia, PA 19107
(215) 629-2990
http://www.asb.org/
Limited funding is available to assist aspiring visually impaired users in the purchase of helpful high-tech equipment.

Association for Education and Rehabilitation of the Blind and Visually Impaired
4600 Duke Street, #430
P.O. Box 22397
Alexandria, VA 22304
http://www.aerbvi.org/modules.php?name=Content&pa=showpage&pid=1
The Association for Education and Rehabilitation of the Blind and Visually Impaired (AER) is the only international membership organization dedicated to rendering all possible support and assistance to the professionals who work in all phases of education and rehabilitation of children and adults with blindness and visual impairment.

Association for Macular Diseases, Inc.

210 E. 64th Street
New York, NY 10021
(212) 605-3719
http://www.macula.org
The Association for Macular Diseases, Inc. is a national support group with local chapters for persons with macular diseases and their families. Information on vision equipment is distributed and support is given to eye donor projects for macular disease research.

Association of Radio Reading Services
P.O. Box 3663
Pittsburgh, PA 15230
(412) 434-6023
http://www.iaais.org/
Over 100 services are provided in the United States. Local services are available in most states. The Associate of Radio Reading Services provides access to printed material for the visually impaired on closed circuit radio. Daily papers, magazines, books, and local information are provided.

Blind Children's Center
4120 Marathon Street
Los Angeles, CA 90029
(323) 664-2153
(800) 222-3566
www.blindcenter.org\bcc
The Blind Children's Center is a nonprofit organization offering a program of diversified services that meet the special needs of children with blindness, vision impairment, and multiple disabilities, from birth through five years of age and their families. Services include an infant stimulation program, parent participation groups, educational preschool, family support services, research program and an interdisciplinary assessment program.

Blinded Veterans Association
477 H Street, NW
Washington, DC 20001
(202) 371-8880
(800) 669-7079
http://www.bv.org
The BVA is a national organization with 52 regional groups that provides information, support, and outreach to blinded veterans. It assists in job searches, provides information on available benefits and rehabilitation programs.

Braille-Revival League
1155 15th Street NW Suite 720
Washington, DC 20005
(202) 467-5081

(800) 424-8666
http://www.bham.ac.uk/is/braille/intro.html
The Braille-Revival League encourages people who are blind to read and write in braille, advocate for mandatory braille instruction in educational facilities for people who are blind, and strives to make available a supply of braille materials from libraries, printing houses, and more.

Business Publishers, Inc.
951 Pershing Drive
Silver Spring, MD 20910-1081
(301) 587-6300
http://www.bpinews.com/
Business Publishers, Inc publishes Directory of Aging Resources, a guidebook listing federal and state government programs, private organizations and other agencies related to aging and blindness.

Clovernook Center for the Blind
7000 Hamilton Avenue
Cincinnati, OH 45231
(513) 522-386
http://www.clovernook.org/0
Clovernook Center for the Blind provides comprehensive rehabilitation services including training and support for independent living, orientation and mobility instruction, vocational training, job placement, counseling, recreation, and youth services. Services are currently offered in three locations: Cincinnati, Ohio; Dayton, Ohio; and Memphis, Tennessee.

Columbia Lighthouse for the Blind
1421 P St. NW
Washington, DC 20005
(202) 462-2900
(877) 324-5252
http://www.clb.org/
Columbia Lighthouse for the Blind offers people who are blind and visually impaired in areas of DC, Maryland, and Virginia training in assistive technology, career development and rehabilitation. This organization also offers services such as braille production, speaker's bureau, visionaries store, volunteer assistance, low vision clinics, and Columbia Extension recreational activities.

Council for Exceptional Children
1920 Association Drive
Reston, VA 20191-1589
(703) 620-3660
(888) CEC-SPED
http://www.cec.sped.org/

The Council for Exceptional Children works to improve the educational outcome of students with disabilities, and has information on educational opportunities, and hosts ERIC (Educational Resources Information Center) clearinghouse on disabilities and gifted education information.

Council of Families with Visual Impairments
c/o American Council of the Blind
1155 15th Street, NW, Suite 1004
Washington, DC 20005
(202) 467-5081
http://www.acb.org/
The Council of Families with Visual Impairments provides support and information for parents of children with blindness and low vision, holds an annual conference, and publishes a newsletter.

Extensions for Independence
555 Saturn Boulevard
San Diego, CA92154
(619) 423-7709
http://mouthstick.net/
Extensions for Independence develop, manufacture, and market vocational equipment for people with vision impairment. They promote improvements in design, materials, production and quality of products while maintaining affordable prices.

Eye Bank Association of America
1015 18th Street, Suite 1010
Washington, DC 20036
(202) 775-4999
http://www.restoresight.org/
Eye Bank Association of America gives research grants to promote transplantation, certifies eye banks, and sets medical standards for corneal transplants. Also provides brochures on the above subjects.

Fidelco Guide Dog Foundation
PO Box 142
Bloomfield, CT 06002
(860) 243-5200
http://www.fiedlco.org
The purpose of the foundation is to breed, train, and place German Shepard guide dogs with people with blindness in the northeast.

Fight for Sight
160 E 56th 8th Floor
New York, NY 10022
(212) 750-5588

http://www.fightforsight.org.uk/
This is an international voluntary health organization that works to conquer low vision and blindness. Grants are provided to accredited medical colleges and institutions to help supply equipment, technical assistance, and materials for research projects and a limited number of clinical service projects.

The Foundation for Fighting Blindness
Executive Plaza 1, 11350 McCormick Rd., Suite 800
Hunt Valley, MD 21030-1014
TDD (800) 683-5551
http://www.blindness.org/
The Foundation for Fighting Blindness is an organization who focuses on finding treatments and cures for macular degeneration, retinitis pigmentosa, Usher syndrome and the entire spectrum of retinal degenerative diseases.

Glaucoma Research Foundation: GLEAMS
200 Pine Street, Suite 200 San Francisco, CA 94104
San Francisco, CA 94102
(415) 986-3162
http://www.glaucoma.org/
The Glaucoma Research Foundation maintains an eye bank for glaucomatous tissue research and provides information about glaucoma.

The Guide Dog Foundation
371 East Jericho Turnpike
Smithtown, NY 11787-2976
(631) 265-2121
(800) 548-4337
http://www.guidedog.org
Guide dogs are provided free of charge to people who are blind who are interested in enhanced mobility and independence.

Guide Dog Users
1155 15th Street NW Suite 720
(202) 467-5081
(800) 424-8666
http://www.gdui.org/
Guide Dog Users promotes the acceptance of people who are blind and their dogs, works for enforcement and expansion of laws admitting guide dogs into public places, and advocates for quality training and follow-up services.

Guiding Eyes for the Blind
611 Granite Springs Road
Yorktown Heights, NY 10598
(800) 942-0149
http://www.guidingeyes.org/about/about.asp

Guide dogs are trained, bred, and raised to help individuals with blindness throughout the country.

Hadley School for the Blind
700 Elm Street
Winnetka, IL 60093
(847) 446-8111
(800) 323-4238
http://www.hadley-school.org/
The Hadley School provides home-study courses for blind children, their parents and blind adults. Their course catalog is available in braille, cassette, large print, or computer disk.

Helen Keller National Center
111 Middle Neck Road
Sands Point, NY 11050
(516) 944-8900
(800) 255-0411
http://www.helenkeller.org/index.html
Helen Keller National Center is a non-profit agency that provides a range of services to visually impaired people of all ages in New York City.

International Agency for the Prevention of Blindness
Building 31 Room 6AO3
Bethesda, MD 20892
(301) 893-2311
http://www.iapb.org/
The agency is an umbrella organization created to coordinate and lead International research into the causes of impaired vision or blindness. They also promote measures to eliminate such causes, and disseminate information worldwide on preventing blindness and on matters pertaining to care of the eyes.

Leader Dogs for the Blind
P.O. Box 5000
Rochester, MI 48308
(248) 651-9011
(888) 777-5332
http://www.leaderdog.org
This nonprofit organization trains dogs and offers them at no charge to people with visual impairments

Library of Congress National Library Service for the Blind and Physically Handicapped
1291 Taylor Street, NW
Washington, DC 20542
(202) 707-5100

(800) 424-8567
http://lcweb.loc.gov/nls/
Books on tape are loaned through the mail and have circulars available including *Assistive Devices for Reading* and *Assistive Technology*.

Library Users of America
American Council of the Blind
1155 15th Street NW Suite 720
Washington, DC 20005
(202) 467-5081
(800) 424-8666
http://libraryusers.tripod.com/
Chapters in states are provided through the US to encourage the development, acquisition, and use of technology that enables blind and visually impaired persons to use printed material independently in library settings and elsewhere.

The Lighthouse International, Inc.
111 East 59th Street 11th Floor
New York, NY 10022
(212) 821-9200
(800) 829-0500
http://www.lighthouse.org/
The Lighthouse International serves as a clearing house for Information on a variety of eye conditions. They also provide local referrals through a database of resources for people with low vision. Lighthouse International Center for Vision and Aging publishes a guidebook entitled *Sound & Sight: Your Second Fifty Years*.

Mobile Association for the Blind
2440 Gordon Smith Drive
Mobile, AL 36617
http://www.mobileblind.com/
Offers work adjustment training, job placement, activities of daily living, mobility, communication skills, and sheltered employment for adults who are visually impaired and for persons with other disabilities.

Myasthenia Gravis Foundation of America
123 W. Madison Street, Suite 800
Chicago, IL 60602
(312) 853-0522
(800) 541-5454
http://www.myasthenia.org/
The foundation provides information, promotes cure of and has professional, educational, and scientific symposia on myasthenia gravis.

National Alliance of Blind Students

1155 15th Street, NW, Suite 1004
Washington, DC 20005
(202) 467-5081
(800) 424-8666
http://www.blindstudents.org/
The National Alliance of Blind Students is a membership organization of college students who are blind and visually impaired with support and information available through their newsletter, The Student Advocate; state chapters; and annual meetings.

National Alliance for Eye and Vision Research
426 C Street, NE
Washington, DC 20002
(202) 544-1880
http://www.eyesearch.org
The National Alliance for Eye and Vision Research (NAEVR) is a non-profit advocacy organization made up of a coalition of professional, consumer, and industry organizations involved in research in eye and vision disorders.

National Association for the Visually Handicapped
22 West 21st Street, 6th Floor
New York, NY 10010
(212) 889-3141
http://www.navh.org/
The National Association for the Visually Handicapped supplies information and referrals to people with vision impairment, offers a large print library, runs self-help groups, counseling and seminars for individuals and professionals, and has a catalog of visual aids and informational materials.

National Association of Blind Students
1800 Johnson Street
Baltimore, MD 21230
(410) 659-9314
http://www.nfbstudents.org/
NABS provides support, information, and encouragement to college and university students who are blind. The association leads the way in offering resources in issues such as national testing, accessible textbooks and materials, overcoming negative attitudes about blindness from school personnel. They also offer strong advocacy and motivational support.

National Association of Guide Dog Users
1800 Johnson Street
Baltimore, MD 21230
(410) 659-9314
http://www.nfb-nagdu.org/

The National Association of Guide Dog Users provides information and support for guide dog users and works to secure high standards in guide dog training. Issues of discrimination of guide dog users are addressed and public education about guide dog use is offered.

National Association to Promote the Use of Braille
1800 Johnson Street
Baltimore, MD 21230
(410) 658-9314
http://www.nfbcal.org/napub/napub.htm
The National Association to Promote the Use of Braille is dedicated to securing improved braille instruction, increase the number of braille materials available to those who read braille, and provide information about the importance of braille in securing education, independence, and employment for those who are blind.

National Braille Association, Inc.
3 Townline Circle
Rochester, NY 14623
(716) 473-5172
http://www.nationalbraille.org/
The National Braille Association, Inc. assists all those involved in the development and improvement of skills and techniques required for the production of reading materials for individuals who read braille. They maintain a collection of braille textbooks, music, technical tables, and general interest materials. It serves as the clearinghouse for the exchange of ideas and suggestions for the improvement of braille and tape transcription techniques.

National Braille Press
St. Stephen Street
Boston, MA 02115
(617) 266-6160
(888) 965-8965
http://www.nbp.org/
The National Braille Press is a leading provide of braille transcription and pressing services. They promote literacy through providing access to books in braille for children and adults.

National Center on Accessible Media
CPB/WGBH National Center for Accessible Media
125 Western Avenue
Boston, MA 02134
617.300.3400
http://ncam.wgbh.org/
NCAM addresses issues involving media and technology for people with disabilities across environments.

National Diabetes Action Network for the Blind
1800 Johnson Street
Baltimore, MD 21230
(410) 659-9314
http://www.nfb.org/diabetes.htm
The Diabetes Action Network provides leading organization of support and information for persons losing vision due to diabetes. They provide personal contact and resource information with other people with diabetes who are blind about non-visual techniques of independently managing diabetes, monitoring glucose levels, and related activities.

National Eye Care Project
Box 429098
San Francisco, CA 94142-9098
(800) 222- EYES (3937)
The National Eye Care Project provides referrals for individuals over 65 who do not have access to an ophthalmologist they have seen in the past. The project is sponsored by the Knights Templar. They do not distribute eyeglasses.

National Eye Institute
Building 31 Room 6A32
Bethesda, MD 20892
(410) 496-5248
(800) 869-2020
http://www.nei.nih.gov/
The mission of the National Eye Institute is to discover safe and effective methods to prevent, diagnose, and treat diseases and disorders of the visual system. In this way the institute helps to prevent, reduce, and possibly eliminate blindness and visual impairment.

National Family Association for Deaf Blind
111 Middle Neck Road
Sands Point, NY 11050
(516) 944-8900
(800) 255-0411
http://www.nfadb.org/
The NFADB is a national organization which advocates for persons who are deaf-blind. The organization supports national policy to benefit people who are deaf-blind and encourages the foundation and strengthening of family organizations in each state dedicated to assisting families of persons who are deaf-blind.

National Federation of the Blind
1800 Johnson Street
Baltimore, MD 21230
(410) 837-6763

www.nfb.org
The NFB is the largest membership organization of people with blindness in the nation, with chapters in every state. It seeks to integrate the blind into society on the basis of equality with the sighted so that people who are blind are seen as normal, participating citizens.

National Industries for the Blind
524 Hamburg Turnpike CN 969
Wayne, NJ 07474
(973) 595-9200
www.nib.org
National Industries for the Blind is a nonprofit organization that represents over 100 associated industries serving people who are blind in thirty-six states. Services include job and family counseling, job skills training, instruction in braille, communication skills, children's programs and more.

National Institute on Aging
Building 31, Room 5C27
31 Center Drive, MSC 2292
Bethesda, MD 20892
Phone: 301-496-1752
www.nia.nih.gov
The NIA provides leadership in aging research, training, health information dissemination, and other programs relevant to aging and older people.

National Library Service for the Blind and Physically Handicapped
1800 Johnson Street
Baltimore, MD 21230
(410) 659-9314
www.loc.gov/nls
The NLS administers a national library service that loans braille and recorded books and magazines at no cost to anyone who cannot read standard print due to physical or visual disability.

National Organization for Parents of Blind Children
1800 Johnson Street
Baltimore, MD 21230
(410) 659-9314
www.nfb.org/nopbc.htm
The NOPBC provides support, information, and advocacy of parents of children who are blind or visually impaired. They address issues ranging from help for parents of a newborn infant who is blind, mobility and braille education, instruction, and many other services.

National Organization of the Senior Blind
1800 Johnson Street

Baltimore, MD 21230
(410) 659-9314
www.nfb.org
The NOSB is a membership organization of elderly persons with blindness that provides support and information to other seniors who are blind. Concerns of the group include remaining active in community and social life, maintaining private homes, and learning to about various vision technologies.

Prevent Blindness America
National Office
500 East Remington Road
Schaumburg, IL 60173-4557
(847) 843-2020
(800) 221-3004
http://www.preventblindness.org/
Local offices sponsor services such as eye screenings and self-help groups for people with glaucoma. They provide an informational newsletter on common eye complaints and conditions often associated with aging and preservation of sight.

Recording for the Blind and Dyslexic
20 Roszel Road
(609) 452-0606
(800) 221-4792
http://www.rfbd.org/
The RFBD provides recorded and computerized textbooks, library services and other educational resources to people who cannot effectively read standard print because of a visual impairment, learning disability, or other physical disability. Two types of membership programs are available: individual and institutional.

Research to Prevent Blindness
645 Madison Avenue, 21st Floor
New York, NY 10022-1010
(212) 752-4333
(800) 621-0026
http://www.rpbusa.org/
Informational brochures on eye conditions are provided, annual grants to medical institutions are made, information on eye research is provided and they advocate for eye research.

RNIB (Royal National Institute of the Blind)
PO Box 173
Peterborough PE2 6WS
0845-702-3153
http://www.rnib.org.uk
The RNIB provides over 60 different services such as education, employment, housing, community services, reading.

The Schepens Eye Research Institute
20 Staniford Street
Boston, MA 02114
(617) 742-3140
http://www.theschepens.org/
The Schepens Eye Research Institute is a prominent center for research on eye, vision, and blinding diseases. It is dedicated to research that improves the understanding, management, and prevention of eye diseases and visual deficiencies. It also fosters collaboration among its faculty members; trains young scientists and clinicians from around the world; and promotes communication with scientists in allied fields. It is considered a leader in the worldwide dissemination of basic scientific knowledge of vision.

Seeing Eye, Inc.
Washington Valley Rd
PO Box 375
(973) 539-4425
Morristown, NJ 07963
http://www.seeingeye.org/
Seeing Eye is a training school for dogs to guide people with blindness.

United States Association for Blind Athletes
33 N Institute Brown Hall
Colorado Springs, CO 80903
(719) 333-4195
www.usaba.org
The USABA is an athletic association for athletes who are blind. It is the governing body for the United States visually impaired athletes.

USA Aniridia Network
1138 N. Germantown Pkwy
Suite 101 PMB #109
Cordova, TN 38016
http://www.aniridia.info/
The mission of USA aniridia Network is to educate the public, teachers, employers and medical personnel who have not had experience with aniridia, the condition, and needs for adaptation and support.

Vision Foundation, Inc.
818 Mount Auburn Street
Watertown, MA 02472
(617) 926-4232
(800) 852-3029
http://www.mablind.org/

Peer counseling, support groups, seminars, information, and referral services for persons with vision loss are offered by Vision Foundation, Inc.

Vision World Wide, Inc.
5707 Brockton Drive No. 302
Indianapolis, Indiana 46220
(317) 254-1332
(800) 431-1739
www.visionww.org
Vision World Wide disseminates relevant information on a variety of topics through its information and referral helpline. The also publish a quarterly journal entitled Vision Enhancement.

VISIONS/Services for the Blind and Visually Impaired
500 Greenwich Street, 3rd Floor
New York, NY 10013-1354
(212) 625-1616
http://www.visionsvcb.org/
VISIONS is a nonprofit agency that provides free services, including self-help study kits, counseling, consumer workshops and information to individuals with visual impairment over 55 in the New York City area.

Wilmer Eye Institute
Johns Hopkins Hospital
600 N. Wolfe Street
Baltimore, MD 21287
(410) 955-5080
http://www.wilmer.jhu.edu/
The Wilmer Institute is known throughout the world for research and the management of exceptionally complex and serious eye diseases.

World Health Organization
Liaison Office in Washington
1775 K Street, N.W., Suite 430
Washington, D.C. 20006
1 (202) 331-9081
http://www.who.int/en/
The objective of the WHO is the attainment of the highest possible level of health for people around the world. The WHO Constitution defines health as a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity.

APPENDIX F.
Publications

AccessWorld: Technology and People with Visual Impairments

Access World Subscription Services - AFB Press
P.O. Box 1020
Sewickley, PA 15143-1020
(888) 522-0220
(412) 741-1142
http://www.afb.org/aw/main.asp
AccessWorld is a bi-monthly periodical for anyone who uses or wants to use assistive technology, provides technology training, has students or clients who use assistive technology, needs to make purchasing decisions, or wants to keep abreast of technological trends and events. It is a publication of the American Foundation for the Blind.

The Braille Forum

1155 15th Street, NW, Suite 1004
Washington, DC 20005
(202) 467-5081
(800) 424-8666
http://www.acb.org/magazine/index.html
The Braille Forum is the monthly magazine of the American Council of the Blind. The Braille Forum promotes independence and effective participation in society. Topics range from discussions of public policy and legislation to technology and current news impacting the vision-impaired community. It is also available in braille, large print, half-speed four-track cassette tape and MS-DOS computer disk.

Journal of Vision Impairment & Blindness

49 Sheridan Avenue
Albany, NY 12210
(412) 741-1398
(800) 232-3044
http://www.afb.org/jvib/main.asp
Journal of Vision Impairment & Blindness is the international, interdisciplinary journal of record on blindness and visual impairment that publishes scholarship and information and serves as a forum for the exchange of ideas, airing of controversies, and discussion of issues. This peer-reviewed journal reports on cutting-edge research, innovative practice, and news on all aspects of visual impairment. It is available online, in print or braille, on cassette and ASCII disk. The Journal of Vision Impairment & Blindness is published by the American Foundation for the Blind. The AFB also publishes the JVIB News Service which

is a bi-monthly publication. Subscriptions can be ordered by calling (800) 877-2693 or (518) 436-9686.

NFB Newsline
National Federation of the Blind
1800 Johnson Street
Baltimore, MD 21230
http://www.nfb.org/newsline1.htm
The NFB Newsline offers a telephone service (with a touch-tone telephone) for access to newspapers and local news. Access to this service is available 24 hours, seven days a week. Through this service, individuals can access the New York Times, Washington Post, and the Wall Street Journal in addition to local newspapers.

Visual Impairment Research
Swets & Zeitlinger Publishers
P.O. Box 825
2160 SZ Lisse
The Netherlands
31 252 435 111
http://www.szp.swets.nl/szp/frameset.htm
Visual Impairment Research is the official publication of the International Society for Low-Vision Research and Rehabilitation. The journal covers the entire field of research and practice in visual rehabilitation assessment in, rehabilitation of, children, multiple disabilities, cognitive impairments, educational programs for rehabilitation workers, and standardized protocols. Within these parameters rehabilitation impairments of visual sensory and oculo-motor functions, as well as impairments of the central visual system are included.

Voice of Vision
http://www.gwmicro.com/vov/
Voice of Vision is published quarterly by GW Micro. It contains information on GW Micro products and discussions of other issues relating to computer access for people who are blind or have low vision.

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